ARMY AIR FORCE
Technical Order No. 08-10-74

PRELIMINARY INSTRUCTIONS

FOR

RADIO SET SCR-AR-183

AND

RADIO SET SCR-AR-283

MANUFACTURED BY
WESTERN ELECTRIC COMPANY

ORDER No. 68-WF-42
ORDER No. 7786-WF-43

PRO PATRIA VIGILANS

RESTRICTED

PUBLISHED BY AUTHORITY
OF
THE CHIEF SIGNAL OFFICER

FOR AIRPLANE TYPE________________

AAF SERIAL No.__________________

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R. & R.—5M—12-42

SPECIAL NOTICE

In Radio Transmitter BC-( )-230 or Radio Transmitter BC-( )-430, a part of Radio Set SCR-( )-183 or Radio Set SCR-( )-283 respectively, care should be exercised in selecting tube types to be used in the oscillator and power amplifier circuits.

For satisfactory performance Tube VT-25 as manufactured by Western Electric Company only, or any Tube VT-25-A shall be used. (Signal Corps Stock No. 2T25A).

The use of other Tube VT-25 as manufactured by other concerns will seriously affect calibration and neutralization of this transmitter.

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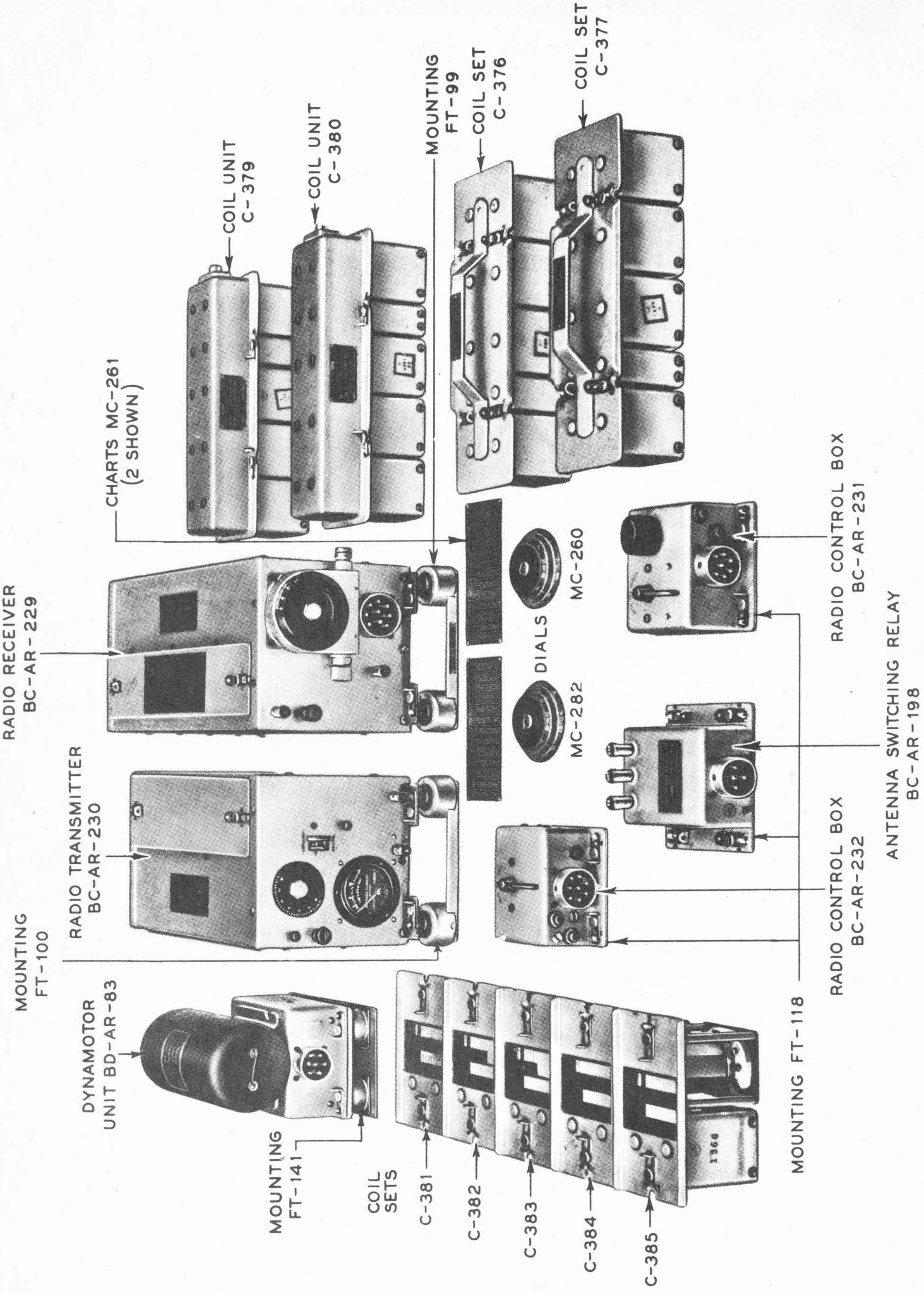
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Restricted

RADIO SET SCR-AR-183

AND

RADIO SET SCR-AR-283

I. DESCRIPTION

GENERAL

Radio Set SCR-AR-183 is intended for installation and operation in aircraft having 12-14.25 volt power supply systems, and Radio Set SCR-AR-283 is suitable for 24-28.5 volt installations. Both sets are identical in physical size and appearance and perform in exactly the same manner. The only differences are in the filament circuits of the receivers and transmitters, and the windings of relay coils and dynamotors. The following description pertains to both sets.

The frequency range of Radio Receivers BC-AR-229 and BC-AR-429 is 201 to 398 kilocycles and 2500 to 7850 kilocycles. (Although it is technically possible to extend the range beyond these bands by the use of additional coil sets, the extension of the frequencies is not authorized for this radio set and such additional coil sets have not been procured and cannot be furnished.) These receivers may be used to receive modulated or damped-wave signals at any frequency within these ranges. The frequency range of Radio Transmitters BC-AR-230 and BC-AR-430 is 2500 to 7700 kilocycles, and they may be used to transmit unmodulated, tone-modulated, or voice-modulated signals at any frequency within this range.

RADIO SET SCR-AR-183

The following component parts were procured on Order No. 68-WF-42 as part of the SCR-AR-183:

		Weight Lbs.
(a)	Radio Receiver BC-AR-229 (includes Mounting FT-99	12.0
(b)	Radio Transmitter BC-AR-230 (includes Mounting FT-100)	10.2
(c)	Dynamotor Unit BD-AR-83 (includes Mounting FT-141 and Sub-base M-158)	9.9
(d)	Radio Control Box BC-AR-231 (receiving) (includes Mounting FT-118)	0.9
(e)	Radio Control Box BC-AR-232 (transmitting) (includes Mounting FT-118)	0.9
(f)	Antenna Switching Relay BC-AR-198 (includes Mounting FT-118)	1.1
(g)	Chart MC-261 (unmounted, receiver calibration from 150 to 12,500 kc, including both dual coil units)	0.1
(h)	Coil Set C-376 (receiving) (2500-4700 kc)	1.75
(i)	Coil Unit C-380 (receiving) (dual, 201-398 kc and 4150-7700 kc)	2.9
(j)	Dial MC-260 (201-398 kc and 4150-7700 kc)	0.07
(k)	Coil Set C-381 (transmitting) (2500-3200 kc)	0.9

		Weight Lbs.
(l)	Coil Set C-382 (transmitting) (3200-4000 kc)	0.9
(m)	Coil Set C-383 (transmitting) (4000-5000 kc)	0.9
(n)	Coil Set C-384 (transmitting) (5000-6200 kc)	0.9
(o)	Coil Set C-385 (transmitting) (6200-7700 kc)	0.9
(p)	Set receiving tubes	0.5
(q)	Set transmitting tubes	0.5
(r)	Coil Set C-377 (receiving) (4150-7850 kc)	1.75
(s)	Coil Unit C-379 (receiving) (dual, 201-398 kc and 2500-4700 kc)	2.9
(t)	Dial MC-282 (201-398 kc and 2500-4700 kc)	0.07

RADIO SET SCR-AR-283

The following component parts are those which must be substituted for similarly lettered parts in the preceding table to make a complete SCR-AR-283 set as procured on Order No. 68-WF-42:

		Weight Lbs.
(a)	Radio Receiver BC-AR-429 (includes Mounting FT-99)	12.0
(b)	Radio Transmitter BC-AR-430 (includes Mounting FT-100)	10.2
(c)	Dynamotor Unit BD-AR-93 (includes Mounting FT-141 and Sub-base M-158)	9.9
(f)	Antenna Switching Relay BC-AR-408 (includes Mounting FT-118)	1.1

The dimensions of the above units are shown in Fig. 2.

The following Signal Corps standard parts are the minimum additional parts required for operation of Radio Sets SCR-AR-183 and SCR-AR-283.

Junction Box (furnished by airplane contractor as part of the airplane) or equivalent circuits (see Fig. 3)

Cord and plugs (see Fig. 1).

Microphone T-17 or Microphone T-20-A with Microphone Amplifying Equipment RC-19-A.

Headset HS-18 or Headset HS-23.

Cord CD-307.

Tuning Unit MC-127 (local, for receiver tuning).

Control Unit MC-137 (local, for dual coil unit band change switch).

Antenna Wire.

Insulators.

II. INSTALLATION

GENERAL

While applicable to all types of aircraft having 12.0 to 14.25 volts supply, Radio Set SCR-AR-183* is primarily designed for single-seat types, and the problems of installation and arrangement are chiefly centered about the rigid requirements which are associated with pilot operation. Before installation of the radio equipment the aircraft engine, generator and accessories, must be completely shielded and bonded if satisfactory radio results are to be obtained. The specifications and requirements for shielding and bonding set forth in Air Corps Technical Orders are adequate for airplanes in which this radio set is to be used. It must be realized that the interference with signal reception, which is produced by the radiation of electrical disturbances from the engine ignition system, charging generator, unbonded contacting metal surfaces, etc., bears no direct relation to the sensitivity of the radio receiver. The relative magnitude of such disturbances at the receiving antenna in comparison with the incoming radio wave field is the factor of prime importance. If the radio field intensity is greater than the local electrical noise level, reception will be possible with any radio receiver sensitive enough to operate on that radio field. The more sensitive the radio receiver, the weaker the radio signal which it will receive, but only so long as the local noise or interference level is less than the incoming radio waves can the signal be heard. Frequently a highly sensitive radio receiver is considered to be noisy when the airplane is in flight simply because it will receive both radio signals and local disturbances which are weaker than those receivable on a relatively insensitive receiver. The proper criterion of a complete job of bonding and shielding is that with the airplane in flight (or with the engine running on the ground) in clear cold weather when static is negligible, no sound will be audible in the headset except radio signals, when the receiver volume control is set at maximum. If the airplane is maintained in this condition, extremely long distance ranges of reception may be obtainable with this equipment.

* Since all installation information for Radio Set SCR-AR-183 is identically applicable to Radio Set SCR-AR-283, only the former is described herein.

RADIO RECEIVER BC-AR-229, RADIO TRANSMITTER BC-AR-230, AND ANTENNAS (receiving and transmitting)

The receiver and transmitter mountings should be permanently mounted at the chosen locations in the airplane (see Fig. 2) and the receiver and transmitter attached to them by means of the snapslides on the mounting brackets. These units may then be unsnapped and removed for inspection or replacement. The snapslides must all be firmly engaged on their respective studs and securely closed.

Radio Set SCR-AR-183 may be operated with separate receiving and transmitting antennas, or with a single antenna. If separate antennas are employed, Antenna Switching Relay BC-AR-198 has no function, and need not be installed or connected through the cord to the junction box. The principles governing the location of antennas and equipment will be discussed mainly with reference to single-seat airplanes because when a suitable arrangement is found for this class of installation, the extension to larger types is relatively simple.

1. *Operation on Seperate Antennas for Receiving and Transmitting.*

The choice of location for the receiver and its mounting in an airplane is governed by several factors: (1) accessibility for coil set and tube replacements; (2) proximity to a suitable location for the receiving antenna lead-in; (3) avoidance of sharp bends in the tuning shaft and cords; (4) weight distribution. Item (1) is of vital importance if coil sets are to be changed in flight. When the equipment is to be confined to missions involving communications within one frequency band this is of less consequence.

Item (2) is particularly important when the equipment is to be used in the high-frequency band. Poor results will be obtained at any frequency if the lead to the receiving antenna is run around the interior of the fuselage for several feet before connecting to the antenna binding post, and this is particularly harmful at high frequencies where dielectric losses are greater. A receiving antenna suitable for the entire frequency range of the receiver will have a small capacity, and additional capacity to the fuselage between the lead-in insulator and the antenna binding post shunts the receiver and may seriously reduce the signal energy reaching it. If for physical reasons it is impossible to position the receiver binding posts closer than about one foot away from the lead-in insulator, the harmful shunting effect of this lead may be reduced by: (a) making it as small a copper wire as is consistent with mechanical strength; (b) choosing a thinly insulated or bare conductor. Heavy rubber insulation on this lead increases its capacity. There is no justification from a radio standpoint for the practice of using rubber-covered ignition cable for this lead. Furthermore, this lead should not be taped to metal longerons or ribs if this can be avoided. The ideal installation would have the receiver connected to the antenna lead-in by means of a single conductor not larger than No. 18 B & S gauge, this conductor being insulated with thin rubber or a wax-impregnated fabric wrap, and suspended in air throughout its length. Conductors of B & S gauge sizes 16 and 18 are suitable for radio receiving antenna connections inside the airplane; the capacity of such a conductor is relatively small, and this lead should be located so that it is not likely to be struck or subjected to stresses involving the tensile strength of the wire. If it is necessary that this lead be longer, and supported along its length, every effort should be made to space it away from metal structure members by at least one-half inch. Glass or porcelain insulators or cleats are ideal for this purpose, but if they are not available, it is preferable to use dry wooden blocks impregnated in paraffin wax as spacers, rather than to lash this conductor direct to metal members. To item (3) must be added the caution to provide sufficient slack in every cord, shaft and conductor attached to the receiver so that the receiver is free to move in every direction with respect to its mounting. If even a single taut wire is attached to the receiver case the airplane vibration will be transmitted direct to the receiver and the effect of the shockproofing will be lost. The ground binding post should be connected by a slack wire to the nearest metal member of the fuselage, using a firm clean joint, preferably soldered. The location and external length of the receiving antenna is usually dictated by considerations of safety and convenience, but a few general principles can be followed. Length of the antenna wire in feet is of no value in itself, nor is electrostatic capacity to the fuselage of any value unless this capacity is obtained in a certain way. An insulated antenna wire lashed along the outside of a metal monocoque fuselage possesses large capacity, but it would not pick up radio signals effectively. The radio antenna is essentially a capacity structure, operating against the bonded airplane frame as a counterpoise. Its effectiveness as a collector of radio waves increases as the length is increased, but only provided that this increase in length is in a direction away from the metal of the airplane. Increasing its capacity by bringing any part of the antenna closer to the airplane usually does more harm than good. Increasing its capacity by increasing the amount of conducting surface of the portion separated from the airplane, without decreasing that separation, tends to improve the antenna as a radio collector. A five-foot vertical mast antenna mounted in the fuselage of the airplane forms a suitable receiving antenna for the radio receiver provided that the lead to the receiver inside the fuselage is not too long. Also, this type of antenna should be located not less than two feet away from the base of the vertical fin, if installed back of the cockpit. On high-speed airplanes a single wire slanting from the lead-in insulator in the headrest fairing up to a stub mast on top of the rudder is sometimes used. This antenna is fairly effective if broken by a strain insulator located 6 to 10 inches ahead of the stub mast, but is not a particularly good radio antenna unless this stub mast extends at least 12 inches above the top of the rudder. A flat-top antenna consisting of a top section strung between the wing tip and rudder, with a down lead connected to this top section at a point well ahead of the rudder is an effective receiving antenna for all biplanes and high-wing monoplanes. It is advisable to keep the remote ends of any wire antenna away from metal end supports. If ends are attached to these supports by stays, the strain insulators separating the stays from the antenna wires should be spaced one foot or more from the metal supports if possible. Down leads from flat-top antennas supported by a high-wing should be brought into the fuselage as near the bottom of the fuselage as possible, since this increases the effective spacing of the top section from the fuselage.

Attention is next directed to the transmitting antenna. The transmitting and receiving antennas form a complementary system, and theoretically a sacrifice in the electrical efficiency of one will harm the system just as much as a sacrifice in the other. But it is a fact of considerable importance that the reduction of the transmitting antenna below a certain minimum of size and efficiency will render the transmitter practically inoperative on account of the unavoidable physical limitations inherent in the method of coupling this unit to its antenna. The transmitter must be used with an antenna at least large enough to draw from the set enough radio current to deflect the antenna-current ammeter, since this deflection is the only direct evidence available to the operator as to the activity of his own transmitter. For practical reasons, therefore, it may be permissible to reduce the receiving antenna to a structure far below that which would be required for effective transmission, in cases where a compromise is demanded somewhere in the system. Three characteristics of the transmitting antenna are important: (1) it should have sufficiently high capacity at the operating frequency, in the portion spaced away from the airplane, so that the greater part of the radio energy goes out into the space part of the antenna and is not dissipated internally in the coupling circuit or fuselage; (2) the antenna resistance should be due largely to radiation and not conductor or dielectric losses; (3) the directions of minimum radiation should be at angles from the airplane which will coincide with the direction of the receiving airplane only in the least probable attitudes of flight. It should be noted here that these desirable characteristics are exactly the same (though described in different terms) as those outlined above for a good receiving antenna. Conditions (1) and (2) might be simultaneously fulfilled by an antenna operated at its fundamental (quarter-wave) frequency against the airplane as counterpoise. But when a number of different transmitting frequencies are to be employed and antennas of adjustable length (trailing wires) are unacceptable, the extremely rapid variation with frequency of the capacity and resistance of a built-on antenna, when operated near its fundamental, makes this mode of operation inflexible and difficult to maintain. Experience has shown that operating an antenna considerably below its fundamental frequency (with a lower radiation resistance and higher antenna current) is just as effective as operating one at its fundamental frequency (with a correspondingly lower antenna current), provided the dielectric and other loss resistances in the antenna are kept small. This principle cannot, of course, be carried to extremes. An antenna which is close to a metal airplane member throughout its length might draw a large current through the transmitter ammeter on account of its high capacity, but the radiation would be practically nil, the excessively high current being itself an indication of negligible power spent in radiation. In quantitative terms, the radio transmitter in combination with an antenna, operates with the greatest overall efficiency as a generator and radiator of radio waves in the 6200 to 7700 kc frequency band if the antenna has a capacity of from 90 to 150 micro-microfarads, and a resistance of from 5 to 10 ohms within this frequency range. Of this resistance, not more than 3 ohms should be dielectric or loss resistance. (The dielectric losses are by far the greatest causes of non-useful power dissipation in the 6200-7700 kc frequency band.) Condition (3) is the most difficult of all the requirements to fulfill, particularly on high speed airplanes. Any conceivable simple antenna will have a certain directivity; it would have at least two directions of minimum radiation even in free space. This free-space directivity may be further complicated by "shadow effects" due to shielding by a metal monococque fuselage, metal struts, flying wires, etc. Furthermore, whenever the transmitting airplane is in such an attitude relative to the receiving airplane that the transmitting lead-in on one is approximately at right angles to the receiving lead-in on the other, a minimum of received signal will be obtained. Theoretically, the type of antennas best calculated to minimize signal variations due to maneuvers of the airplanes would be straight conductors supported by masts which are vertical in level flight of both the transmitting and receiving airplanes. A height of five feet away from the fuselage is about the maximum tolerable length, and while such a structure can be coupled effectively into the receiver its capacity is so low that the transmitter will not feed it efficiently.

A transmitting antenna which will fulfill the general requirements outlined above, in the 6200-7700 kc frequency band, consists of a "T" structure having a flat-top section which is between 16 to 18 feet long, with a down lead about 9 feet long to the lead-in insulator. If an "L" antenna is used its total length from the lead-in insulator to the end of the top section should be 20 to 25 feet. Such an antenna would not radiate efficiently in the 2500-5000 kc band. This lower frequency band can be used most effectively only on airplanes of sufficient size or wingspread to allow the use of an antenna of approximately twice the size outlined for the 6200-7700 kc band. In other words, the total length of wire should be of the order 35-50 feet including the down-lead, for use in the lower frequency band. An antenna consisting of a "V" shaped flat top about 25 feet long on each leg, with a down lead about 10 feet long may be used with fair success in this band.

NOTE: The lead inside the fuselage to the transmitter antenna binding post must be short, and must be either bare or insulated with high-quality insulation regardless of the location of the transmitter.

This lead cannot be run around the airplane inside the fuselage, since the power output and antenna radiation at these high frequencies will be affected to a controlling extent by the length and capacity of this lead. Rubber or fabric covered conductors must not be used if they can possibly be avoided. The ideal form for this lead is a conductor of No. 16 or No. 18 bare wire, insulated by beads of glass or porcelain. If such insulation is not available, and the lead may come in contact with metal, rubber insulation may be used without rendering the transmitter inoperative, but it will reduce the radiated power. Wherever space is available, this lead should be supported by glass or porcelain stand-off insulators. The portion adjacent to the transmitter should not be drawn taut. While it is seldom possible to make an ideal arrangement, the following general rule should serve as a guide in all cases: Try to keep the capacity elements of the antenna all outside the fuselage and minimize the capacity of all conductors inside the fuselage; where such capacity exists inside the fuselage, let the dielectric (insulators) consist of air, glass, or porcelain wherever possible. All insulators should be glass or porcelain. Under no circumstances should phenolic insulators such as bakelite be used here. If ceramic insulators are not obtainable, hard rubber is preferable to bakelite. The ground binding post of the transmitter is bonded to the fuselage by a permanent short lead, which should have sufficient slack so as not to impair the shockproofing action of the mounting.

When using separate antennas the receiver may be mounted back of the seat, with its axis of length across the fuselage, and its antenna binding post wired to a separate lead-in insulator. The receiving antenna may be smaller than the transmitting antenna, as outlined above, and may consist of a simple mast.

2. *Operation on Single Antenna*

If Radio Receiver BC-AR-229 and Radio Transmitter BC-AR-230 are to operate from the same antenna through the use of Antenna Switching Relay BC-AR-198, it is essential that the receiver and transmitter be mounted close to each other, in order to meet the requirement stated above that the lead inside the fuselage to the transmitter binding post must be short. For best results the separation between these units should not exceed about one foot. For example, satisfactory operation using a single antenna cannot be obtained if the transmitter is mounted in the cockpit of a pursuit type airplane and the receiver is mounted back of the seat, as is common practice when separate antennas are employed. If the structure of the airplane is such that these units must be separated to such an extent, the use of a single antenna for transmitting and receiving should not be attempted. If these units can be mounted close together, preferably side by side, the antenna switching relay should be so positioned and mounted that its binding posts are not over one foot away from the antenna binding posts of both receiver and transmitter and also as close as possible to the lead-in insulator of the common antenna. The cord from the relay to the junction box should be bonded to the metal members of the airplane at frequent intervals along its length. Three short leads should be used to connect (a) the antenna to the ANT binding post of the relay; (b) the receiver A binding post to the REC binding post of the relay; (c) the transmitter A binding post to the TR binding post of the relay. The ideal form for these three leads is a conductor of No. 16 or No. 18 bare wire insulated by beads of glass or porcelain. If supports are necessary these leads should be supported by glass or porcelain stand-off insulators. Do not use heavy rubber-covered wire for any leads to or from the antenna switching relay, and do not tape these leads to metal members of the airplane. The G binding posts of receiver and transmitter must be grounded by short leads to the nearest metal members of the airplane. With regard to the dimensions of the single transmitting-receiving antenna, this antenna should be designed to provide the best operating conditions for the transmitter. In other words, the instructions given in the preceding paragraph for the transmitting antenna should be followed in building a single antenna for transmission and reception.

* This is 4 amperes in the SCR-AR-283 Radio Set.

RADIO CONTROL BOX BC-AR-231 AND RADIO CONTROL BOX-BC-AR-232

Radio Control Box BC-AR-231 (receiving) must be accessible to the operator whether the equipment is pilot-operated and remotely controlled, or locally controlled. Radio Control Box BC-AR-232 (transmitting) is used for key transmission and selection of the type of emission from the transmitter, and not for the changeover operation between send and receive. If communications are to be confined to voice only, Radio Control Box BC-AR-232 need not be as accessible as Radio Control Box BC-AR-231 if it is necessary to favor one at the expense of the other. During any series of communications the switch on Radio Control Box BC-AR-231 must be used to turn the equipment off and on, and the volume control knob will also be used constantly. These units have no shock-proofing and are attached to their Mountings FT-118 by means of snapslides. The mountings may be screwed directly to the cowling or to a panel inside the cockpit (see Fig. 2 for mounting holes).

DYNAMOTOR UNIT BD-AR-83

The location of Dynamotor Unit BD-AR-83 is a matter of comparative indifference so far as the operation of the unit itself is concerned, but it is inadvisable to mount it closer than two feet from the receiving antenna lead-in. Dynamotor Unit BD-AR-83 should be mounted in an upright position with Mounting FT-141 so located or positioned as to be horizonal in normal flight. The unit should be so located that its cord is no longer than necessary, since this cord carries a relatively heavy supply current. The voltage drop in this cord when carrying 8 amperes* should, in no case, exceed .5 volt. Mounting FT-141 is permanently fixed in the airplane and the unit may be removed for inspection or replacement by releasing the snapslides (see Fig. 2).

JUNCTION BOX

In new airplanes the junction box is furnished and installed in the airplane by the airplane manufacturer. It should provide the circuits shown in Fig. 3 for proper operation of the radio set.

TUNING AND CONTROL UNITS AND SHAFTS

Certain Signal Corps tuning and control units are required for the operation of this radio set, and their proper location is indicated diagrammatically in Fig. 1. The receiver will normally be remotely tuned by means of Tuning Unit MC-125 and Tuning Shaft MC-124. The tuning unit should be mounted near Radio Control Box BC-AR-231 (receiving) since it will be used during the operation of the receiver. The tuning shaft may be bent more than once throughout its length but no bends should be permitted of radius less than 6 inches. The shaft may be firmly secured to a rigid support at frequent intervals along its length, except at points close to its attachment to the receiver. If both these precautions are not observed it will be difficult to tune the receiver accurately. When properly installed, even with lengths of 20 feet or more of shaft, both dials should rotate smoothly without appreciable backlash as the crank of the tuning unit is turned. When the shaft is attached to outlet 261 on the receiver and to the tuning unit, the reading of the tuning unit dial must be made to coincide with the reading of the receiver dial by rotating one of them before the final coupling is made.

The dual coil unit switch may be operated remotely by means of Control Unit MC-135 through Control Shaft MC-134 if desired. This control shaft differs from the tuning shaft in that it has direct coupling between the gang switch and the control unit lever, and is consequently stiffer than the tuning shaft. Any bends in a control shaft must be of the greatest possible radius. In the case of the dual coil unit the control shaft carries a considerable load (the gang switch in the coil unit) and extra precautions must be observed on installation. Before mounting Control Unit MC-135 the spline of this unit should be inserted into the control shaft and the switch should be turned clockwise to be certain that the coil unit gang switch is set for the LOW range. Disengage Control Unit MC-135 and re-engage the spline in one of the four ways which will locate the lever, when set for the LOW range, in the most desirable position. Rotate the dial until LOW is indicated by the pointer and then tighten up on the coupling nut. Do not attempt to rotate the dial of Control Unit MC-135 after this operation. The dial should then be secured in position by screws attached to the unit. When properly assembled the changeover between the HIGH and LOW bands of the coil unit, by means of the lever on Control Unit MC-135, should be positive and reversible.

Tuning and control shafts can be obtained from depots in any required length and should never be cut unless proper equipment is available for re-attaching the splines. Each shaft consists of a casing terminating in a ferrule and a coupling nut; this houses the shafting, terminating in an assembly of a spline on a spline-ferrule. The shafting is made up of tightly wrapped steel wires which will not hold their shape unless they are soldered or swaged together at the ends. All tuning and control shafts should be taped and bonded.

CORDS

The cords which inter-connect the various units, if not in rigid metal conduit, should be lashed or clamped to structural members of the airplane along their length. Cords which are covered with metal braid may produce an electrical noise in the receiver unless they are carefully bonded to metal airplane members wherever they are likely to touch or rub thereon. In the best installations such cords are bonded at intervals of approximately 18 inches and the intervening lengths, between bonds, are wrapped with friction tape or similar insulation, to eliminate all possibility of receiver "noise" arising from this source.

The cord to the battery terminates at its battery end in a pair of open terminals. These must be connected to the 12-14.25 volt line as near to the battery as practicable. If a conductor of any length whatever carrying current from the charging generator to the battery is included in the circuit between the positive conductor of this cord and the battery terminal, this may produce electrical noise in the receiver which will come from the voltage regulator.

In case it becomes necessary to alter or assemble a shielded cord, the attachment of the plug should be made as indicated below. The plugs for these cords consist of a shell, insulator body, spring, bushing, washer, nut and screw. Cut the cordage off squarely across the end. Then cut the metal shielding braid back a distance of 1-3/16 inches from the end; with a sharp knife or scissors cut the rubber jacket back a distance of ¾ inch from the end, taking care not to damage the rubber insulation of the individual conductors. Then clean the insulation on each individual stranded conductor back a distance of 5/32 inch from the end. Disassemble the plug by removing the screw and nut. Pass the nut, washer and shell over the cleaned end of the cable, in the order named. Having threaded the cable through these parts, "tin" the end of the braid with hot solder, fit the bushing over the end of the cable and braid, so that the braid is covered to a distance of ⅜ inch, and sweat the braid into the bushing so that a secure soldered contact is made between the bushing and the braid. Tin each individual contact insert and solder the cleaned ends of the conductors into these inserts. Both the inserts and the conductors must be thoroughly tinned before this operation. Do not allow surplus lumps of solder to remain on these inserts or on any part of the bakelite insulation. When all conductors are securely soldered, bunch the insulated portions together so that they will not rub on the shell when the plug is reassembled. Draw the shell up to the shoulder on the bushing and fasten it securely by tightening the nut. As this operation is performed, the hairpin spring must be held in close contact with the inner surface of the shell, with the two studs protruding through the holes in the top of the shell. As the shell is drawn up to the shoulder of the bushing, the insulator body, now attached to the cable, should be drawn into this shell so that the spring passes into and is held in the square groove in the top of the insulator body. Line up the screw hole in this shell with the threaded hole in the bottom of the insulation and complete the assembly by tightening the screw in this hole. Do not used acid flux or paste in soldering; use only resin flux. If acid flux is used in soldering the conductors, the plug will ultimately break down in service.

When open wire cables are required they should be assembled in accordance with the procedure outlined in the preceding paragraph. The conductors in each cable should be lashed together and the cables should be lashed to structural members of the airplane.

III. PREPARATION FOR USE

The receiver output circuit and transmitter sidetone circuit are arranged to permit the use of two 8,000 ohm or two 600 ohm headsets in parallel. The receiver and transmitter are supplied with these circuits wired for the high impedance (8,000 ohm) headsets. When low impedance headsets are to be used the receiver and transmitter should be modified as follows:

Remove from filter choke 94 in the receiver the black wire from 55 on receptacle plate 163, and connect the wire to terminal 4 on output transformer 71.

Remove the black wire connected to terminal 7 on modulation transformer 124 in the transmitter and connect the wire to terminal 6 on the same transformer.

ADJUSTMENT OF RADIO RECEIVERS BC-AR-229 AND BC-AR-429

The final installation operation of the receiver is the alignment of the antenna circuit of the receiver by means of the input condenser 80*, adjusted by knob 244. If the antenna used is so large that its characteristics vary widely with frequency over the operating range, this adjustment must be made for each coil set. If the antenna is small, or consists of a rigid mast, one adjustment may give satisfactory results for all coil sets. The receiver is operated with switch 134* at MANUAL. A signal is tuned in at the high-frequency end of one of the bands, preferably in the high-frequency band of Coil Set C-380. The volume control must be progressively retarded during the adjustment to keep the signal at the lowest audible level. Knob 244 is turned until the signal is a maximum. Then the receiver tuning must be readjusted for maximum and knob 244 adjusted again for resonance. If the receiver is to be operated for a considerable period in the low-frequency band only, this antenna alignment may be performed near the maximum dial (frequency) setting on the low-frequency coil set. But for use throughout the entire range, the antenna alignment must be performed on the high-frequency band.

Do not operate the receiver with any coil set if it is impossible (owing to the size or arrangement of the antenna and lead-in) to adjust knob 244 for resonance as indicated by maximum signal. The overall sensitivity will be low and the results will be unsatisfactory unless condenser 80, controlled by knob 244, is accurately adjusted.

ADJUSTMENT OF RADIO TRANSMITTERS BC-AR-230 AND BC-AR-430

The transmitter must be tuned and adjusted on the ground for operation at the desired transmitting frequency. It should be tuned over dry soil; otherwise the tuning of the antenna circuit may change when the plane leaves the ground. The transmitter cannot be properly tuned inside a hangar. Three controls must be adjusted for any given frequency: (1) the frequency control 241; (2) the antenna coupling tap, adjusted by contact 130*; (3) the antenna tuning condenser, adjusted by knob 243. The frequency control 241 (which operates the variable condenser of the radio master oscillator) should be set at the desired transmission frequency, locked with lock screw 250 and left alone. Then the antenna coupling and tuning (coil tap 130* and condenser knob 243) must be adjusted by trial to give the most favorable combination of antenna carrier current, indicated by ammeter 129*, and modulation. Proper adjustment of the antenna circuit is particularly important in the case of Radio Transmitters BC-AR-230 or BC-AR-430 because operation with the wrong setting of the coil tap may result in dynamotor and vacuum tube overload as well as poor modulation even though the antenna circuit is tuned to resonance. The following explanation should be studied and carefully applied.

With the switch on Radio Control Box BC-AR-232 set on VOICE, the frequency control set at the desired frequency, and the antenna and ground connected to the proper binding posts,

* See Fig. 3.

find a position for coil contact 130 at which maximum (resonance) antenna current may be obtained by rotating condenser knob 243; note the value of antenna current at this setting. Then remove the transmitter coil set, change the position of contact 130 by one or two turns, replace the coil set and retune to resonance with knob 243, noting the new resonance value of antenna current. Repeat this operation of adjusting contact 130 and retuning to resonance until the position has been found for the coil contact at which the antenna current reaches its highest value when the circuit is tuned to resonance by condenser knob 243. It will be noted at most operating frequencies that the antenna current at resonance does not change appreciably between one turn of the antenna coil and the next adjacent turns on each side, throughout a certain region on the coil in the vicinity of maximum power output. But at certain locations of contact 130, better modulation will be obtained than at other locations, and good modulation is just as important in voice transmission as high antenna current. In the absence of any direct means of checking modulation, the direct plate current of the amplifier tube, measured on a d-c milliammeter plugged into jack 128* on the transmitter, may be used as a practical indicator of the extent to which the radio amplifier may be modulated without distortion. In general, the greater the amplifier plate current, at resonance, when the transmitter is tuned and operating on VOICE, the smaller will be the power available for modulation, and the smaller the modulation capability of the transmitter. But the radio carrier current (indicated by antenna ammeter 129) generally decreases with decreasing plate current drawn by the amplifier; thus a compromise must be made, in choosing the final location for coil contact 130. In choosing this compromise location, the following practical data will be of assistance. They apply to a transmitter operating at 14 volts supply voltage with average tubes. For 12 volts supply the corresponding plate currents are 20% lower than those given below.

With settings of the coil contact at which the amplifier plate current is less than about 25 milliamperes the radio output will be modulated up to 100% with negligible distortion.

With settings of the coil contact at which the amplifier plate current is between 25 and 30 milliamperes the radio output will be modulated to about 90% with negligible distortion.

With settings of the coil contact at which the amplifier plate current is between 30 and 35 milliamperes the radio output will be modulated to about 80% with negligible distortion.

With settings of the coil contact at which the amplifier plate current is greater than about 35 milliamperes the output cannot be modulated above 70-75% without serious distortion and such settings should be avoided.

All the above values apply to operation at antenna resonance, obtained by tuning with knob 243. If the antenna circuit is mistuned, all plate currents will be abnormally high and satisfactory modulation cannot be obtained at any antenna coupling. Consideration of the preceding four paragraphs indicates a working rule for final choice of position for the antenna coil contact, as follows:

At any given frequency coil contact 130 should be set for the highest antenna current (on meter 129) which can be obtained without drawing an amplifier plate current, at resonance, which exceeds about 34 milliamperes at 14 volts supply or about 28 milliamperes at 12 volts supply. This will permit modulation of at least 80%, with normal modulator tubes, at a carrier current output which is practically the maximum attainable. It will be noted that moving the coil contact down toward the coil base from the point just specified (i.e. decreasing the coupling to the antenna) usually decreases the amplifier plate current at resonance and improves the modulation, but at the expense of decreased antenna current. This observation suggests the following rough rule for tuning the transmitter in the absence of a d-c milliammeter for measuring the amplifier plate current:

If a d-c milliammeter is not available for indicating plate currents when the transmitter is being tuned, set coil contact 130 on the turn which gives the maximum antenna current at resonance, then move it down toward the base

* See Fig. 3.

of the coil (restoring resonance at each move by adjusting knob 243) until the antenna current on meter 129 is reduced by a small amount, say 5%, below its maximum resonance value. In other words, operate the transmitter with the antenna coupled through contact 130 by an amount slightly less than the coupling which gives an absolute maximum of antenna current.

WARNING: The transmitter must never be operated, except during the tuning process, with the antenna mistuned from resonance. The tubes and dynamotor unit are liable to damage and proper modulation cannot be obtained, unless the antenna circuit is operated at resonance as indicated by the antenna ammeter.

TRANSMITTER FREQUENCY CALIBRATION

Each transmitter coil set is provided with a calibration chart showing the approximate dial settings in 50 or 100 kc steps for frequencies throughout its range. These figures are average data secured from a great number of coil sets and transmitters and cannot be applied with precision to a particular transmitter. They are intended merely as a guide for use in arriving at an exact setting.

To determine an exact dial setting, proceed as follows:

1. Set the frequency control to the desired frequency as indicated by the coil set calibration chart.
2. Tune the antenna circuit to resonance, using the antenna coil tap which gives maximum antenna current and satisfactory voice modulation.
3. Allow the transmitter to warm up for five minutes.
4. Readjust the frequency control for zero beat with a crystal-controlled frequency standard whose frequencies are known with a maximum error of 0.05%. Frequency Meter Sets SCR-211-A, SCR-211-B and SCR-211-C are more accurate than the above value.
5. After readjusting the antenna circuit for resonance, make a final adjustment of the frequency control to obtain a zero beat signal.

The settings of the frequency control and antenna tap for each operating frequency should be determined by the above method. These data and suitable means for identifying the particular coil set and transmitter should be recorded.

If the oscillator tube is replaced at any time the data for one frequency should be rechecked. If the output frequency is found to differ from the frequency standard, this should be corrected by adjusting trimmer condenser 120, accessible under cover 288 on the transmitter case. When zero beat has been obtained at one of the operating frequencies, the calibration data will be correct for each of the operating frequencies.

IV. OPERATION OF RADIO SET SCR-AR-183 OR SCR-AR-283

GENERAL

Radio Control Box BC-AR-231 controls all power to the equipment. When switch 134 is in the OFF position the dynamotor unit is disconnected and power is thrown off the filaments of both receiver and transmitter for all positions of all other controls. The switch on Radio Control Box BC-AR-231 has two positions at which the dynamotor runs (AUTO and MANUAL), and this switch determines the type of reception. The switch on Radio Control Box BC-AR-232 determines the type of transmission, and the application of the dynamotor output voltage (whether to the receiver or to the transmitter) may be determined by operating a remote control switch plugged into the junction box, the microphone switch, or the key. The following is a summary of the power connections accompanying each position of the main switches:

Radio Control Box BC-AR-231:

OFF: Dynamotor off. Receiver and transmitter filaments off.

MANUAL: Dynamotor on. Receiver and transmitter filaments on. Plate voltage on either transmitter or receiver.

AUTO: Dynamotor on. Receiver and transmitter filaments on. Plate voltage on either transmitter or receiver.

Radio Control Box BC-AR-232: (With switch on Radio Control Box BC-AR-231 at MANUAL or AUTO and a control switch closed to transmit):

TONE: Transmitter filaments on. Plate voltage off receiver. Plate voltage on all transmitter tubes. Modulator generates tone oscillations.

CW: Transmitter filaments on. Plate voltage off receiver; on all transmitter tubes. Modulator generates tone oscillations.

VOICE: Transmitter filaments on. Plate voltage off receiver; on all transmitter tubes. Tone oscillations suppressed.

RECEIVER OPERATING TEST

After installation and before flying with the radio equipment a receiver operating test should be made, for which detailed instructions follow:

1. Determine the frequency band in which test signals will be available, and plug the appropriate coil set into the receiver. See that the full frequency range on the tuning dials can be swept through for the chosen position of the tuning unit pointer without encountering the stops on this unit. The tuning unit should turn easily and smoothly and should not be forced at any time.

2. Plug a headset into a jack on Radio Control Box BC-AR-231. Turn the switch to MANUAL. The dynamotor should start and as soon as the receiving tubes are warm, a slight hum should be heard in the headset indicating that the receiver is operating. The first test should be made without running the airplane engine. When the receiver is in operating condition at full voltage, atmospherics and electrical disturbances are usually heard at the maximum position of the volume control. Under most conditions the receiver cannot be expected to operate satisfactorily on signals so weak that maximum sensitivity is required to make them audible, because such signals are usually below the atmospheric noise levels.

3. Tune in signals by rotating the tuning unit crank. As the receiver is tuned, adjust the volume control knob for suitable signal intensity.

4. Switch to the AUTO position of the control switch after a desired signal is tuned in. The

signal intensity in the headset will not necessarily be the same for the same setting of the volume control in the AUTO and MANUAL positions. In the AUTO position, reset the knob for a suitable level in the headset. If the mean radio field strength is high enough to require substantial retardation of the control knob for a comfortable signal output in the MANUAL position, the signal output in the AUTO position will be maintained constant by the automatic gain control of the receiver. Do not attempt to tune in signals with the switch on AUTO, because the resonance effect in the amplifier is apparently broadened (the amplifier gain varies with the strength of the amplified radio voltage in this position) so that the proper tuning point cannot be found except for very weak signals. The AUTO position is not designed for constant use throughout a series of communications on different frequencies, but only as an aid to reception after a signal has been tuned in on the MANUAL position.

5. Before flying with the receiver the installation should be further checked with the airplane engine running. If, with the volume control set at maximum, at any position of the tuning dial the electrical noise in the headset is increased on starting the airplane engine, imperfect shielding of the ignition or generator system or difficulty with the voltage regulator of the charging generator is indicated. If circumstances render necessary the operation of the receiver under these conditions, only those radio signals can be satisfactorily received which are of greater electrical intensity than the local disturbance.

6. The switch on Radio Control Box BC-AR-231 should never be left in the MANUAL or AUTO positions when the receiver is not in use.

TRANSMITTER OPERATING TEST

After installation and before flying with the radio equipment a transmitter operating test should be made, for which detailed instructions follow:

1. With a headset in the jack in Radio Control Box BC-AR-231, plug a microphone into jack 138 in Radio Control Box BC-AR-232, and set the controls at MANUAL and VOICE. The dynamotor should run, and the receiver should operate.

2. Press the switch on the microphone. A click should be heard in the headset, and the antenna-current ammeter should deflect to a reading of at least 0.5 ampere. Talk into the microphone. Voice sidetone should be heard in the headset, and the antenna current should vary with voice modulation. If the antenna current does not vary with voice modulation, either the transmitter is not being modulated or it is improperly tuned. (See instructions for tuning on page 10.)

3. Throw the Radio Control Box BC-AR-232 switch to TONE, and press either the microphone switch or the key. A steady tone should be heard in the headset, and the antenna current should increase appreciably above the value observed on VOICE. If the antenna current does not increase on TONE, the transmitter is improperly tuned. (See instructions for tuning on page 10.)

4. Throw the Radio Control Box BC-AR-232 switch to CW, and press either the microphone switch or the key. A steady tone should be heard in the headset, but the antenna current should be the same as on VOICE.

MICROPHONE TECHNIQUE

Voice communication from an airplane is always characterized by restricted ranges of operation as compared with communication by CW and tone telegraph. Signal fading, airplane noises, electrical interference, atmospherics, and the like all conspire to rob a voice-modulated radio signal of its intelligibility. For that reason it is of the utmost importance that voice communication, when used, should originate at the microphone under the most favorable conditions. All audible flight noises are picked up by the microphone and transmitted through the radio set. It is impossible to eliminate them to a marked degree without also eliminating the intelligence-bearing frequencies of the human voice. The operator can favor his voice and discriminate against flight noises only by keeping his lips close to the microphone. Flight noises cannot be drowned out by shouting into the microphone; this is a bad practice from all standpoints, since it produces fatigue and distortion in the human larynx and also overloads the equipment. The following simple rules may be depended upon, if followed consistently, to produce the best results in voice transmission from any radio equipment:

1. Hold the microphone close to the face, with lips just touching the surface. Keep the head in a vertical position while transmitting, so that the plane of the microphone face is substantially vertical.

2. Do not shout. Forget the noise surrounding you and imagine that you are talking directly into the ears of the listener.

3. Finish each word completely before starting the next.

4. Emphasize with a distinct hiss all sibilants, such as "S," "C," and "Z."

5. Emphasize all terminal consonants, such as "T" and "G."

6. Speak slowly.

CHOICE OF FREQUENCY

Radio communication ranges are limited by signal fading (see below), atmospherics, and steady decay of received signal with distance. The best frequency for transmission between two given points varies with the altitude, the distance, and the time of day, but there are a few general rules which will greatly assist in minimizing the importance of this general variability. For distance up to 50 miles communication is improved with increasing altitude between two airplane stations, or between airplane and ground, at all frequencies. At distances over 150 miles, if communication is possible at all, it will be little affected by altitude of either station. For plane-to-plane communication at distances up to 20 miles there is little choice between frequencies in the low bands (2500-5000 kc) and frequencies in the high bands (5000-8000 kc). For plane-to-ground communication at any distance less than about 100 miles frequencies in the low bands are better than frequencies in the high bands. Communication over distances of 200 miles or more, at any altitude of either station, may be possible with frequencies in the high bands but should not be expected on frequencies in the low bands. As to the distinction between day communication and night communication, the lower frequencies are better on the average at night, and the higher frequencies are better by day; this rule applies generally to distances of the order of 100 miles and more. For short-distance work with a ground station, frequencies in the lower band should be used, if possible, without regard to the time of day. Frequencies in the upper part of the low band, say 4000-5000 kc, are best for general utility purposes, plane-to-plane, or plane-to-surface, over a variable distance range.

CHOICE OF TYPE OF TRANSMISSION

The CW position of the Radio Control Box BC-AR-232 selector switch will give the same antenna current as the VOICE position. The TONE position will give the same carrier power output as the VOICE position but it will be modulated with a 1000 cycle tone. For long-range communication, or communication through interference, CW is most effective, TONE next, and VOICE least effective. It should be borne in mind, however, that although CW will give the greatest distance range and the greatest range through interference, it requires an oscillating receiver at the receiving station. It is sometimes more difficult, because of the sharper receiver tuning, to establish initial communication by CW than by TONE.

OPERATING ROUTINE

The operating routine of the equipment and the choice among various types of transmission will be dictated primarily by tactical requirements and considerations external to the radio equipment. There are a few general rules which, if followed closely, will increase the number of successful radio contacts.

1. Do not take off with airplanes with which communication is desired, without first establishing communication on the ground. This is particularly important if communication is to be carried on with airplanes transmitting at different frequencies.

2. Whenever possible, with an assembly of airplanes which are to work on the same assigned frequency, calibrate all of the transmitters with a standard frequency oscillator (see page 12). If a standard frequency oscillator is unavailable, adjust all transmitters so that their carrier frequencies beat together in a common monitoring receiver.

3. Do not expect uninterrupted communication between airplanes which are maneuvering unless they are close together. For consistent communication at distances greater than about five miles the communicating airplanes should be in substantially level flight. Vertical banks are usually the attitudes of minimum received signal between two communicating airplanes, unless they both bank in the same direction. Furthermore, a dead spot of communication may be observed when the receiving airplane is off, either above or below, the pole of the transmitting down lead.

4. Operations may be accelerated if orders are acknowledged by single pre-coded signals on the telegraph key.

5. Do not expect to obtain consistent distance ranges on VOICE in excess of twenty-five miles. In the absence of atmospherics and local disturbances, plane-to-plane ranges as high as one hundred miles may be obtained. Radio Set SCR-AR-183 is designed for a voice distance range of twenty-five miles, and greater ranges, even though sometimes unavoidable, are not conducive to secrecy of communication. The distance range on key will normally be greater than the distance range using voice modulation.

6. The radio field strengths received on the ground will always be less than those received in the air at a given time of day, unless the transmitting airplane is so high that an optical path lies between it and the ground station.

7. Transmission will vary from month to month and from day to day, owing to the varying characteristics of the medium of propagation. Signal strengths at distances above about fifteen miles will usually be greater in winter than in summer, and may vary widely from hour to hour on a summer day. This variation is unavoidable and has nothing to do with the radio equipment.

8. Signal fading (i.e. rapid variations) will be encountered more and more as the distance of transmission is increased. Sometimes this will be so rapid as to produce severe distortion of modulated signals. It occurs more at long distances, but may be observed at distances as short as ten miles on some occasions. If the quality of the signals suddenly becomes bad at distances of ten miles or more, a fault in the apparatus is not necessarily indicated. A test should be made with the transmitting and receiving stations in sight of each other before looking for trouble in the equipment.

V. MAINTENANCE

The radio set should be inspected before every radio flight, according to the following routine:

PRE-FLIGHT INSPECTION

1. See that the proper coil set is in the receiver.

2. Check the operation of the switch controls. Set the switch on Radio Control Box BC-AR-231 at MANUAL and be sure that the receiver is operating. Listen for dynamotor noise with the volume control advanced to maximum. Negligible dynamotor noise should be heard.

3. Check the receiver input alignment by tuning in a weak signal and varying the position of knob 244 to make sure that the input circuit is tuned to resonance.

4. Turn up the airplane engine past the speed at which the charging generator cuts in and check ignition and generator noise.

5. Check the headset cord and plug for open or intermittent contacts. Check the headset.

6. Set the switch on Radio Control Box BC-AR-232 at VOICE and note the transmitter current reading. Modulate the transmitter. If the transmitter is operating properly the antenna current will increase with the modulation. Note sidetone in the headset.

> NOTE: Never operate the radio equipment on the ground longer than is necessary to complete this inspection. Never leave the airplane without turning the switch on Radio Control Box BC-AR-231 to OFF.

SERVICE INSPECTION

A detailed inspection of the radio set should be made at periods set up by the Air Corps for inspection and overhaul of the airplane. The following points should be covered in addition to those which experience and local conditions indicate to be necessary or desirable.

1. Check the tubes on the tube test set.

2. Using a high-resistance voltmeter, measure voltages to ground of the various terminals in the junction box as listed in Table II, page 19. Satisfactory operation cannot be expected unless these voltages are all within about 10 per cent of their rated values.

3. Check the bonding of cables and the contacts of antenna and ground wires with their respective binding posts on the receiver and transmitter.

4. Clean all antenna insulators, particularly those which are exposed to the engine exhaust, and check the contacts on the lead-in insulators.

Note on DYNAMOTOR: If the receiver is operating satisfactorily with dynamotor noise at a suitably low level, the dynamotor unit should be left alone. When this machine is in proper condition, manipulation of the brushes or commutators is apt to do more harm than good. The dynamotor may require lubrication about every 300 hours of operation. Access to the bearings is obtained by removing end covers P-3391, held by screws P-3596. Do not put much lubricant in these bearings. Do not use vaseline or any other lubricant not prepared specially for ball bearings. G.E. Ball Bearing Grease is recommended for use in dynamotor ball bearings. If rough turning or excessive looseness is noticed after the bearings have been cleaned and greased, the dynamotor unit should be replaced and the unsatisfactory one should be shipped to a depot for repairs. No attempt should be made to replace dynamotor bearings except at authorized repair shops. Never allow oil or grease to get on the commutators of the dynamotor. Remove dirt, grease or oil from the commutators with a clean dry cloth. *Do not use sandpaper or emery cloth on either commutator.* In time the commutators will be covered with a dark or semi-transparent film which is not a cause of noise and should be preserved thereon. The only other parts that are apt to require replacement during the life of the machine are high-voltage brushes P-5102 and P-5103 and low-voltage brushes P-3679E and

P-3680E. Removal of end covers P-3391 gives access to the brushes. To remove a worn brush, unscrew brush cap P-5009 which frees the brush and spring assembly. Be sure that the new brush is installed with the polarity marking on the upper side. New brushes on both commutators must be run in by operating the dynamotor at normal load for several hours before placing it in service. Proper brush seating is essential for satisfactory operation. A dynamotor with new brushes will be noisy and inefficient until the brushes are properly run in.

USE OF VOLTAGE AND CURRENT TABLES

Tables I-IV which follow give different values of current and voltage in various points in the circuit of the radio sets. These tables are useful in checking the performance of equipment suspected of faulty operation. All voltage readings are made with a high resistance voltmeter.

In Table I are shown typical values of current measured at Jacks 127 and 128 in the radio transmitter. For measurement of these currents an external DC milliammeter of 100 or 150 milliamperes full scale is required. This instrument and its connecting cord and plug (Plug PL-55 or equivalent) must be insulated for the full plate voltage of the equipment. SEE SAFETY NOTICE.

In Table II are listed the DC voltages which can be measured at the indicated terminals in the junction box or at the same numbered terminals on the other units connected to the junction box.

Table III lists the normal plate and bias voltages at the tube sockets in the radio transmitters.

Table IV lists the voltages at the tube sockets in the radio receivers.

TABLE I

(See Instructions on Pages 10 to 12)

Frequency (kc)	*Antenna** Coil Tap*	*Modulator-Oscillator Plate Current*		*Amplifier Plate Current*		*Antenna Current*	
		*12 Volts**	*14 Volts**	*12 Volts**	*14 Volts**	*12 Volts**	*14 Volts**
6200	10	.077 a.	.088 a.	.028 a.	.034 a.	.80 a.	.95 a.
6500	9	.077	.088	.028	.034	.81	.96
6800	9	.077	.088	.028	.034	.83	.98
7100	8	.078	.090	.028	.034	.83	.98
7400	8	.083	.098	.028	.034	.83	.98
7700	7	.089	.105	.027	.032	.80	.92

*In Radio Set SCR-AR-283, these voltages are double the values shown.

**The figures in this column represent the number of turns on the antenna coil between tap 130 and the base of the coil, setting this tap in each case for the best combination of radio power output and modulation. At every point, a somewhat higher tap would give slightly greater power output, but at the expense of greater amplifier plate current and less modulation. The antenna coil tap should never be left at a point at which the amplifier plate current exceeds about 36 milliamperes on 14 volts* or about 30 milliamperes on 12 volts*. On the other hand, the transmitter should not be so tuned that the modulator-oscillator current exceeds 120 milliamperes at 14 volts* or 105 milliamperes at 12 volts*.

TABLE II

TYPICAL JUNCTION BOX VOLTAGES

Controls at MANUAL, VOICE, Transmit

Voltage to Ground 12 Volts Supply*	*Voltage to Ground* 14 Volts Supply*	*Terminals*
11.5*	13*	34, 35, 38, 45, 63, 94
12*	14*	25, 44, 91
265	305	20, 22, 41, 42
285	325	21, 26, 29, 40
300	340	31, 57

2-7 volts on 33 and 51, depending upon the resistance of the microphone. (Zero voltage on all other terminals.)

Controls at MANUAL, VOICE, Receive

Voltage to Ground 12 Volts Supply*	*Voltage to Ground* 14 Volts Supply*	*Terminals*
11.6*	13.2*	33, 34**, 35, 38, 45, 48, 51, 63, 65, 67, 94
12*	14*	25, 44, 91
216	250	39, 56
310	355	26, 29, 30
260	300	31, 57

(Zero voltage on all other terminals)

NOTE: All the voltages listed above will vary somewhat with lengths of cords, age of tubes, and condition of circuit resistors. Check the tubes independently and measure circuit resistances and continuity.

* In Radio Set SCR-AR-283, these voltages are double the values shown.

** In Radio Set SCR-AR-283, this is 11.6—13.2 volts.

TABLE III

TYPICAL PLATE AND BIAS VOLTAGES IN RADIO TRANSMITTERS BC-AR-230 AND BC-AR-430

Controls at MANUAL, VOICE, Transmit

Tube	*Grid Bias to Ground* *12 Volts**	*14 Volts**	*Plate Voltage to Ground* *12 Volts**	*14 Volts**
Radio Oscillator (VT-25-A)	—	—	180	210
Modulators (VT-52)	45**	55**	265	310
Radio Amplifier (VT-25-A)	45	55	260	305

TOTAL INPUT TO EQUIPMENT

Supply Voltage	*(Transmit Voice) Supply Current†*	*(Receive Only) Supply Current†*
12*	7.5 a.	4.8 a.
14*	8.5	5.2

NOTE: All the voltages listed above will vary somewhat with lengths of cords, age of tubes and condition of circuit resistors. Check the tubes independently and measure circuit resistances and continuity.

* In Radio Set SCR-AR-283, these voltages are double the values shown.

† In Radio Set SCR-AR-283, these currents are approximately one half the values shown.

** In Radio Set SCR-AR-283, the bias voltage on one modulator tube will be approximately 7 volts higher than on the other tube.

TABLE IV

TYPICAL PLATE, SCREEN AND BIAS VOLTAGES IN RADIO RECEIVERS BC-AR-229 AND BC-AR-429

Controls at MANUAL, Receive

Control grids short-circuited to ground. Volume control at maximum. All bias voltages measured with respect to ground.

Tube	*Heater Volts* *12*	*14*	*24‡*	*28‡*	*Screen Grid Volts* *12**	*14**	*Plate Volts* *12**	*14**	*Control Grid Bias (Cathode to Ground) Volts* *12**	*14**
First VT-49	5.9	6.8	17.8	20.8	105	121	220	255	5.4	6.5
Second VT-49	11.8	13.6	23.8	27.8	105	121	218	250	5.4	6.5
Third VT-49	11.8	13.6	11.8	13.8	105	121	216	248	5.0	6.2
Fourth VT-49	5.9	6.8	5.9	6.8	210	245	214	245	15.0	18.0
VT-37	5.9	6.8	5.9	6.8	—	—	—	—	—	—
VT-38	11.8	13.6	11.8	13.8	210	245	230	260	21.0	24.0

NOTE: All the voltages listed above will vary somewhat with lengths of cords, age of tubes, and condition of circuit resistors. Check the tubes independently and measure circuit resistances and continuity.

* In Radio Set SCR-AR-283, these voltages are double the values shown.

‡ In Radio Set SCR-AR-283, the heater voltages are as given in the above table.

VI. REFERENCE LIST

OF UNITS AND PARTS OF UNITS OF RADIO SET SCR-AR-183 AND SCR-AR-283

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
**Radio Receiver BC-AR-229*		Western Electric Company, Inc.	ES-690916	
†*Radio Receiver BC-AR-429*		Western Electric Company, Inc.	ES-690968	
Mounting FT-99		Western Electric Company, Inc.,	ES-679763	
1a	By-pass Condenser, Screen Grid, 0.1 mfd., Paper	Western Electric Company, Inc. Two-Section Unit	1574	
2a	By-pass Condenser, Plate, 0.1 mfd., Paper			
1b	By-pass Condenser, Screen Grid, 0.1 mfd. Paper	Western Electric Company, Inc., Two-Section Unit	1574	
2b	By-pass Condenser, Plate, 0.1 mfd., Paper			
1c	By-pass Condenser, Screen Grid, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1574	
2c	By-pass Condenser, Plate, 0.1 mfd., Paper			
3a	By-pass Condenser, Cathodes, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1572	
4a	Filter Condenser, Grids, 0.1 mfd., Paper			
3b	By-pass Condenser, Cathode, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1572	
5b	By-pass Condenser, Heater, 0.1 mfd., Paper			
3c	By-pass Condenser, Cathode, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1572	
4b	Filter Condenser, 0.1 mfd., Paper			
5a	By-pass Condenser, Heater, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1572	
†5c	By-pass Condenser, Heater, 0.1 mfd., Paper			
6	By-pass Condenser, Cathode, 0.5 mfd., Paper	Western Electric Company, Inc.	1573	
7	By-pass Condenser, Plate, 0.5 mfd., Paper	Western Electric Company, Inc.	1573	
8	By-pass Condenser, Cathode, 1.0 mfd., Paper	Western Electric Company, Inc., Two-Section Unit (2 x 0.5)	1575	
9a, 9b, 9c	Filter Condensers, each 0.004 mfd., Mica	Aerovox Corporation, Type 1461	P-437	
11	Coupling Condenser, 0.006 mfd., Mica	Aerovox Corporation, Type 1461	P-91	

*Denotes parts used in Radio Set SCR-AR-183 only.
†Denotes parts used in Radio Set SCR-AR-283 only.
All other parts are used in both radio sets.

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
12	Filter Condenser, 0.0001 mfd., Mica	Aerovox Corporation, Type 1465	P-94	
58a, b, c, d	Amplifier Tuning Condensers, Variable, Gang	Western Electric Company, Inc.	2461	
59b, c, d	Amplifier Aligning Condensers, Fixed, air	Assembled with item 58	—	
61a, 61b, 61c, 61d, 61e, 61f, 61g	Decoupling Resistors, each 200 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-497	
67	Grid Resistor, 2,000,000 ohms Ceramic	International Resistance Company, Type F-1/3	3070	
68	Plate Resistor, 500,000 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-493	
69	A.G.C. Filter Resistor, 2,000,000 ohms, Carbon	Allen Bradley Company, Type E	P-503	
70	Grid Resistor, 2,000,000 ohms, Carbon	Allen Bradley Company, Type E	P-503	
71	Output Transformer, Step-Down, 2.9/1 Ratio	Western Electric Company, Inc.	ES-690658	
72	Filter Resistor, 100,000 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-501	
73	Bias Resistor, 2,000 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-499	
78	By-pass Condenser, Plate, 0.2 mfd., Paper	Western Electric Company, Inc., Two-Section Unit (2 x 0.1)	1574	
79	Compensating Condenser, 9 mmfd., Mica	Western Electric Company, Inc. (Part of Coil Panel Assembly 2464, or ES-691964)	—	
80	Input Alignment Condenser, Variable	Western Electric Company, Inc.	2957	
84	Antenna Binding Post	Western Electric Company, Inc.	2716	
86	Ground Binding Post	Western Electric Company, Inc.	2715	
87	Neon Tube	Western Electric Company, Inc.	FR-6	
88a, 88b	Bias Resistors, each 750 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-509	
94	Output Filter Choke, 0.41 henry	Western Electric Company, Inc.	2465	
97	Coupling Condenser, 0.00012 mfd. ± 10%, Mica	Western Electric Company, Inc.	ES-690947-1	
98	Bias Resistor, 300 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-533	
99	Decoupling Resistor, 5,000 ohms ± 5%, Carbon	Allen Bradley Company, Type E	P-505	
145	Voltage Divider Resistor, 7,000 ohms ± 2%, Center Tap, Special Finish	Western Electric Company, Inc.	3068	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
162	Receptacle Ring for Plug PL-61, Part of Socket SO-41	Western Electric Company, Inc.	1351	
163	Receptacle Plate for Plug PL-61, Part of Socket SO-41	Western Electric Company, Inc.	2810, or ES-691980	
240	Receiver Dial	Western Electric Company, Inc.	2722	
244	Input Alignment Condenser Knob	Western Electric Company, Inc.	3007, or ES-691802-3	
252	Shock-proof Cup Assembly	Western Electric Company, Inc.	3835	
253	Shock-proof Cup Assembly	Western Electric Company, Inc.	3836	
254	Snapslide	Western Electric Company, Inc. (Part of Mounting Bracket Assembly F-486)	2540	
255	Snapslide Stud (for coil compartment)	Western Electric Company, Inc. (Part of Cabinet Assembly 2456)	1089	
256	Snapside Stud (for tube compartment)	Western Electric Company, Inc. (Part of Cabinet Assembly 2456)	1089	
257	Five-prong Tube Socket	Western Electric Company, Inc.	3536	
259	Pin Plug	Western Electric Company, Inc. (Part of Coil Panel Assembly 2464),	2661	
		or Western Electric Company, Inc. (Part of Coil Panel Assembly ES-691964)	ES-691967	
260	Control Grid Clip	National Company, Type 24	2313	
261	Tuning Outlet, right	Western Electric Company, Inc. (Part of Dial Gear Unit FR-127)	FR-122	
262	Tuning Outlet, left	Western Electric Company, Inc. (Part of Dial Gear Unit FR-127)	FR-121	
266	External (Male) Spline, right	Western Electric Company, Inc. (Part of Dial Gear Unit FR-127)	FR-120	
267	External (Male) Spline, left	Western Electric Company, Inc. (Part of Dial Gear Unit FR-127)	FR-119	
268	Cap Nut (for tuning outlet)	Western Electric Company, Inc. (Part of Dial Gear Unit FR-127)	G-169	
271	Snapslide Stud (for FT-99)	Western Electric Company, Inc. (Part of Shock-proof Cup Assemblies 3835 and 3836)	3831	
272	Tube Cover Assembly	Western Electric Company, Inc.	ES-679764	
273	Cabinet Assembly	Western Electric Company, Inc.	ES-679738	
274	Front Panel	Western Electric Company, Inc. (Part of Chassis Assembly 2922)	2392	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
275	Dial Gear Unit	Western Electric Company, Inc.	FR-127	
276	Tube Shield	Western Electric Company, Inc. (Part of Chassis Assembly 2922)	WE-2	
277	Aligning Condenser Cover	Western Electric Company, Inc. (Part of Cabinet Assembly 2456)	1546	
281	Coil Panel Assembly	Western Electric Company, Inc.	2464, or ES-691964	
284	Mounting Bracket Assembly	Western Electric Company, Inc.	F-486	
361	Chart MC-261	Western Electric Company, Inc.	ES-691696-1	
†500	Filament Series Resistor, 40 ohms ± 2%, 15 watts, Special Finish	Ward Leonard Electric Corp.	ES-676125	
Coil Set C-376 (2500-4700 Kc) (Receiving)		Western Electric Company, Inc.	ES-679745	
13	Coupling Condenser, 0.0001 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-520	
66	Grid Resistor, 30,000 ohms ± 5%, Carbon	Continental Carbon Inc., Type K7	P-450	
89	Tuned Input Coil Assembly	Western Electric Company, Inc.	2556	
90a, 90b, 90c,	Tuned Coupling Coil Assemblies	Western Electric Company, Inc.	2556	
91a	Coupling Coil, Tuned Coupling Coil Assembly	Western Electric Company, Inc.	2606	
92	Band-pass Coil Assembly	Western Electric Company, Inc.	2568	
93a	Coil, Band-pass Coil Assembly	Western Electric Company, Inc.	2578	
95a	Input Coil, Tuned Input Coil Assembly	Western Electric Company, Inc.	2606	
254	Snapslide	Western Electric Company, Inc. (Part of Coil Cover Assembly 1739)	2540	
Coil Unit C-380 (201-398 and 4150-7700 Kc) (Receiving)		Western Electric Company, Inc.	ES-679758	
13	Coupling Condenser, 0.00025 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-516	
66	Grid Resistor, 30,000 ohms ± 5%, Carbon	Continental Carbon Inc., Type K7	P-471	
82	Voltage Divider Condenser, 0.0005 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-515	
89	Tuned Input Coil Assembly	Western Electric Company, Inc.	2736	
90a, 90b, 90c	Tuned Coupling Coil Assemblies	Western Electric Company, Inc.	2736	
91a	Coupling Coil, Tuned Coupling Coil Assembly, High	Western Electric Company, Inc.	1758	
91b	Coupling Coil, Tuned Coupling Coil Assembly, Low	Western Electric Company, Inc.	2708	
92	Band-pass Coil Assembly	Western Electric Company, Inc.	2734	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
93a	Coil, Band-pass Coil Assembly, High	Western Electric Company, Inc.	2706	
93b	Coil, Band-pass Coil Assembly, Low	Western Electric Company, Inc.	2707	
95a	Input Coil, Tuned Input Coil Assembly, High	Western Electric Company, Inc.	1758	
95b	Input Coil, Tuned Input Coil Assembly, Low	Western Electric Company, Inc.	2708	
254	Snapslide	Western Electric Company, Inc. (Part of Coil Cover Assembly 1212)	2540	
286	Switch Shaft	Western Electric Company, Inc.	1009	
287	Switch Shaft Outlet	Western Electric Company, Inc.	1837	
Coil Unit C-377 (4150-7850 Kc) (Receiving)		Western Electric Company, Inc.	ES-679746	
13	Coupling Condenser, 0.00025 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-516	
66	Grid Resistor, 15,000 ohms ± 5%, Carbon	Continental Carbon Inc., Type K7	P-471	
89	Tuned Input Coil Assembly	Western Electric Company, Inc.	2557	
90a, 90b, 90c	Tuned Coupling Coil Assemblies	Western Electric Company, Inc.	2557	
91a	Coupling Coil, Tuned Coupling Coil Assembly	Western Electric Company, Inc.	2607	
92	Band-pass Coil Assembly	Western Electric Company, Inc.	2569	
93a	Coil, Band-pass Coil Assembly	Western Electric Company, Inc.	2589	
95a	Input Coil, Tuned Input Coil Assembly	Western Electric Company, Inc.	2607	
254	Snapslide	Western Electric Company, Inc. (Part of Coil Cover Assembly 1739)	2540	
Coil Unit C-379 (201-398 and 2500-4700 Kc) (Receiving)		Western Electric Company, Inc.	ES-679757	
13	Coupling Condenser, 0.0001 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-520	
66	Grid Resistor, 15,000 ohms ± 5%, Carbon	Continental Carbon Inc., Type K7	P-471	
82	Voltage Divider Condenser, 0.00025 mfd. ± 5%, Mica	Cornell-Dubilier Corporation, Type 5	P-516	
89	Tuned Input Coil Assembly	Western Electric Company, Inc.	2735	
90a, 90b, 90c	Tuned Coupling Coil Assemblies	Western Electric Company, Inc.	2735	
91a	Coupling Coil, Tuned Coupling Coil Assembly, High	Western Electric Company, Inc.	2609	
91b	Coupling Coil, Tuned Coupling Coil Assembly, Low	Western Electric Company, Inc.	2708	
92	Band-pass Coil Assembly	Western Electric Company, Inc.	2571	
93a	Coil, Band-pass Coil Assembly, High	Western Electric Company, Inc.	2581	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
93b	Coil, Band-pass Coil Assembly, Low	Western Electric Company, Inc.	2582	
95a	Input Coil, Tuned Input Coil Assembly, High	Western Electric Company, Inc.	2609	
95b	Input Coil, Tuned Input Coil Assembly, Low	Western Electric Company, Inc.	2708	
254	Snapslide	Western Electric Company, Inc. (Part of Coil Cover Assembly 1212)	2540	
286	Switch Shaft	Western Electric Company, Inc.	1009	
287	Switch Shaft Outlet	Western Electric Company, Inc.	1837	
**Radio Transmitter BC-AR-230*		Western Electric Company, Inc.	ES-690914	
†*Radio Transmitter BC-AR-430*		Western Electric Company, Inc.	ES-690936	
Mounting FT-100		Western Electric Company, Inc.	ES-679762	
84	Antenna Binding Post	Western Electric Company, Inc.	2716	
86	Ground Binding Post	Western Electric Company, Inc.	2715	
100	Filter Resistor, 100,000 ohms ± 5%, Carbon	Allen Bradley Company, Type EB	4062	
101	Drop Resistor, 100 ohms ± 5%, Carbon	Allen Bradley Company, Type EB	4063	
102	Drop Resistor, 7,000 ohms ± 2%, Special Finish	Western Electric Company, Inc.	3067	
103	Load Resistor, 10,000 ohms ± 5%, Special Finish	Western Electric Company, Inc.	3066	
104	Bias Resistor, 20,000 ohms ± 5%, Carbon	Allen Bradley Company, Type EB	4064	
105	Grid Resistor, 30,000 ohms ± 5%, Carbon	Allen Bradley Company, Type EB	P-504	
106	Coupling Condenser, 0.006 mfd., Mica	Aerovox Corporation, Type 1461	P-91	
107	Tone Oscillator Condenser, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1572	
109	By-pass Condenser, Plate, 0.1 mfd., Paper			
110a, 110b	By-pass Condensers, Plate, each 0.006 mfd., Mica	Aerovox Corporation, Type 1461	P-91	
111	Filter Condenser, 25 mfd., Electrolytic	Western Electric Company, Inc.	2468	
112	By-pass Condenser, Plate, 0.1 mfd., Paper	Western Electric Company, Inc., Two-Section Unit	1574	
113	By-pass Condenser, Grid, 0.1 mfd., Paper			
114	Grid Condenser, 0.00012 mfd. ± 10%, Mica	Western Electric Company, Inc.	ES-690947-1	
115	Shunt Resistor, 1,000,000 ohms, Carbon	Allen Bradley Company, Type EB	4066	
116	Radio Oscillator Tuning Condenser, Variable, Air, Assembled with 117, 120	Western Electric Company, Inc.	3996	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
117	Radio Oscillator Padding Condenser, Fixed, Air	Assembled with 116, 120	3996	
118	Antenna Tuning Condenser, Variable, Air	Western Electric Company, Inc.	2257	
119	Balancing Condenser, Mica	Western Electric Company, Inc.	ES-681994-1	
120	Compensating Condenser, Air	Assembled with 116, 117		
123	Microphone Transformer, Step-up, 40/1 Ratio	Western Electric Company, Inc.	2444	
124	Modulation Transformer, Step-up, 3/1 Ratio	Western Electric Company, Inc.	ES-690659	
125	Tone Oscillator Coil Assembly, 2/1 Ratio	Western Electric Company, Inc.	2644	
127	Modulator-Oscillator Plate Current Jack	Western Electric Company, Inc.	G-600	
128	Amplifier Plate Current Jack	Assembled with item 127	—	
129	Antenna Current Ammeter, 0-1.5 Amperes	Weston Electrical Instrument Corp., Model 507	2451	
168	Receptacle Ring for Plug PL-64 (Part of Socket SO-44)	Western Electric Company, Inc.	1351	
169	Receptacle Plate for Plug PL-64 (Part of Socket SO-44)	Western Electric Company, Inc.	2850, or ES-691981	
170	Balancing Condenser, Fixed, 3 mmfd. ± 0.25 mmfd.	Erie Resistor Corp., Type P120K	ES-681499	
†174	Filament By-pass Condenser, 0.006 mfd., Mica	Aerovox Corporation, Type 1461	P-91	
241	Frequency Control Knob	Western Electric Company, Inc.	G-278	
242	Frequency Control Dial	Western Electric Company, Inc.	2721	
243	Antenna Condenser Knob	Western Electric Company, Inc.	2138, or ES-691802-1	
250	Frequency Control Lock Screw	Western Electric Company, Inc.	1919, or ES-690698	
251	Antenna Condenser Lock Screw	Western Electric Company, Inc.	G-622, or ES-690699	
252	Shock-Proof Cup Assembly (for FT-100)	Western Electric Company, Inc.	3835	
253	Shock-Proof Cup Assembly (for FT-100)	Western Electric Company, Inc.	3836	
254	Snapslide	Western Electric Company, Inc. (Part of Mounting Bracket Assembly F-486)	2540	
255	Snapslide Stud (for coil compartment)	Western Electric Company, Inc. (Part of Cabinet Assembly ES-679737)	1089	
256	Snapslide Stud (for tube compartment)	Western Electric Company, Inc. (Part of Cabinet Assembly ES-679737)	1089	
258	Four-Prong Socket	Western Electric Company, Inc.	3534	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
259	Pin Plug	Western Electric Company, Inc. (Part of Coil Panel Assembly 2453),	2661	
		or Western Electric Company, Inc. (Part of Coil Panel Assembly ES-691963)	ES-691967	
271	Snapslide Stud (for FT-100)	Western Electric Company, Inc. (Part of Shock-Proof Cup Assemblies 3835 and 3836)	3831	
278	Cabinet Assembly	Western Electric Company, Inc.	2449	
279	Front Panel	Western Electric Company, Inc. (Part of Chassis Assembly 3577),	2068	
		or Western Electric Company, Inc. (Part of Chassis Assembly ES-690700)	ES-690701	
280	Tube Cover Assembly	Western Electric Company, Inc.	1663	
282	Coil Panel Assembly	Western Electric Company, Inc.	2453, or ES-691963	
283	Balancing Condenser Cover	Western Electric Company, Inc. (Part of Chassis Assembly 3584, or ES-690702)	1546	
284	Mounting Bracket Assembly	Western Electric Company, Inc.	F-486	
288	Compensating Condenser Cover	Western Electric Company, Inc. (Part of Cabinet Assembly ES-679737)	1546	
289	Compensating Condenser Control Shaft	Western Electric Company, Inc. (Part of Oscillator Condenser Assembly 3996)	ARC-51	
290	Tube Retainer	Western Electric Company, Inc.	3647	
Coil Set C-381 (2500-3200 Kc) (Transmitting)		Western Electric Company, Inc.	ES-679751	
121	Antenna Coil Assembly	Western Electric Company, Inc.	2749	
122	Radio Oscillator Coil Assembly	Western Electric Company, Inc.	2743	
126	Coil Resistor, 50 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-535	
130	Antenna Tap	Western Electric Company, Inc.	2052	
254	Snapslide	Western Electric Company, Inc. (Part of Cover and Shield Assembly 2259)	2540	
Coil Set C-382 (3200-4000 Kc) (Transmitting)		Western Electric Company, Inc.	ES-679752	
121	Antenna Coil Assembly	Western Electric Company, Inc.	2750	
122	Radio Oscillator Coil Assembly	Western Electric Company, Inc.	2744	
126	Coil Resistor, 100 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-536	
130	Antenna Tap	Western Electric Company, Inc.	2052	
254	Snapslide	Western Electric Company, Inc. (Part of Cover and Shield Assembly 2259)	2540	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
Coil Set C-383 (4000-5000 Kc) (Transmitting)		Western Electric Company, Inc.	ES-679753	
121	Antenna Coil Assembly	Western Electric Company, Inc.	2751	
122	Radio Oscillator Coil Assembly	Western Electric Company, Inc.	2745	
126	Coil Resistor, 75 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-507	
130	Antenna Tap	Western Electric Company, Inc.	2052	
254	Snapslide	Western Electric Company, Inc. (Part of Cover and Shield Assembly 2259)	2540	
Coil Set C-384 (5000-6200 Kc) (Transmitting)		Western Electric Company, Inc.	ES-679754	
121	Antenna Coil Assembly	Western Electric Company, Inc.	2752	
122	Radio Oscillator Coil Assembly	Western Electric Company, Inc.	2746	
126	Coil Resistor, 75 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-507	
130	Antenna Tap	Western Electric Company, Inc.	2052	
254	Snapslide	Western Electric Company, Inc. (Part of Cover and Shield Assembly 2259)	2540	
Coil Set C-385 (6200-7700 Kc) (Transmitting)		Western Electric Company, Inc.	ES-679755	
121	Antenna Coil Assembly	Western Electric Company, Inc.	2753	
122	Radio Oscillator Coil Assembly	Western Electric Company, Inc.	2747	
126	Coil Resistor, 50 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-535	
130	Antenna Tap	Western Electric Company, Inc.	2052	
254	Snapslide	Western Electric Company, Inc. (Part of Cover and Shield Assembly 2259)	2540	
Radio Control Box BC-AR-231 (Receiving)		Western Electric Company, Inc.	ES-679760	
Mounting FT-118		Western Electric Company, Inc.	2475	
60	Bias Resistor, 200 ohms ± 5%, Carbon	Allen Bradley Co., Type E	P-497	
131	Manual Sensitivity Control Resistor, Variable, 0-40,000 ohms	Allen Bradley Co., Type AA	3474	
132	A.G.C. Level Adjusting Resistor, Variable, 0-30,000 ohms	Allen Bradley Co., Type AA	3474	
133	Double Headset Jack	Western Electric Company, Inc.	2473	
134	Rotary Switch Assembly	Western Electric Company, Inc.	3039	
135	Base Assembly	Western Electric Company, Inc.	2474	
166	Receptacle Ring for Plug PL-104 (Part of Socket SO-84)	Western Electric Company, Inc.	1349	
167	Receptacle Plate for Plug PL-104 (Part of Socket SO-84)	Western Electric Company, Inc.	3596, or ES-691984	
254	Snapslide	Western Electric Company, Inc. (Part of Base Assembly 2474)	2540	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
259	Pin Plug	Western Electric Company, Inc. (Part of Receptacle Plate Assembly 3596),	2661	
		or Western Electric Company, Inc. (Part of Receptacle Plate Assembly ES-691984)	ES-691967	
263	Switch Handle	Western Electric Company, Inc.	G-204	
265	Volume Control Knob	Western Electric Company, Inc.	3047, or ES-691802-6	
365	Snapslide Stud (for FT-118)	Western Electric Company, Inc. (Part of Mounting Assembly 2475)	G-591	
Radio Control Box BC-AR-232 (Transmitting)		Western Electric Company, Inc.	ES-679739	
Mounting FT-118		Western Electric Company, Inc.	2475	
135	Base Assembly	Western Electric Company, Inc.	2474	
138	Microphone Jack	Western Electric Company, Inc.	2016	
139	Telegraph Key Assembly	Western Electric Company, Inc.	1602	
140	Key Jack	Assembled with item 138		
141	Rotary Switch Assembly	Western Electric Company, Inc.	2477	
142	Key Adjusting Screw	Western Electric Company, Inc.	G-635	
170	Receptacle Ring for Plug PL-63 (Part of Socket SO-43)	Western Electric Company, Inc.	1350	
171	Receptacle Plate for Plug PL-63 (Part of Socket SO-43)	Western Electric Company, Inc.	2866, or ES-691982	
254	Snapslide	Western Electric Company, Inc. (Part of Base Assembly 2474)	2540	
259	Pin Plug	Western Electric Company, Inc. (Part of Receptacle Plate Assembly 2866),	2661	
		or Western Electric Company, Inc. (Part of Receptacle Plate Assembly ES-691982)	ES-691967	
263	Switch Handle	Western Electric Company, Inc.	G-204	
365	Snapslide Stud (for FT-118)	Western Electric Company, Inc. (Part of Mounting Assembly 2475)	G-591	
**Antenna Switching Relay BC-AR-198*		Western Electric Company, Inc.	ES-679759	
†*Antenna Switching Relay BC-AR-408*		Western Electric Company, Inc.	ES-679765	
Mounting FT-118		Western Electric Company, Inc.	2475	
135	Base Assembly	Western Electric Company, Inc.	2474	
173	Receptacle Ring for Plug PL-77 (Part of Socket SO-57)	Western Electric Company, Inc.	1349	
175	Receptacle Plate for Plug PL-77 (Part of Socket SO-57)	Western Electric Company, Inc.	2963, or ES-691983	
254	Snapslide	Western Electric Company, Inc. (Part of Base Assembly 2474)	2540	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
259	Pin Plug	Western Electric Company, Inc. (Part of Receptacle Plate Assembly 2963),	2661	
		or Western Electric Company, Inc. (Part of Receptacle Plate Assembly ES-691983)	ES-691967	
*285	Antenna Relay Assembly	Western Electric Company, Inc.	2537	
†285	Antenna Relay Assembly	Western Electric Company, Inc.	ES-676122	
332	Binding post (ANT)	Western Electric Company, Inc.	2806	
333	Binding Post (TR)	Western Electric Company, Inc.	2808	
334	Binding Post (REC)	Western Electric Company, Inc.	2807	
365	Snapslide Stud (for FT-118)	Western Electric Company, Inc. (Part of Mounting Assembly 2475)	G-591	
Miscellaneous Items				
	Dial MC-282	Western Electric Company, Inc.	ES-679748	
360	Dial MC-260	Western Electric Company, Inc.	2728	
361	Chart MC-261	Western Electric Company, Inc.	ES-691696-1	
**Dynamotor Unit BD-AR-83*		Western Electric Company, Inc.	ES-679750	
†*Dynamotor Unit BD-AR-93*		Western Electric Company, Inc.	ES-679769	
Mounting FT-141		Western Electric Company, Inc.	2483	
Spare Brushes (Two of each brush)		Pioneer Gen-E-Motor Corp.	P3679E P3680E P5102 P5103	
146	Filter Resistor, 5000 ohms ± 2%, Porcelain, Special Finish	Western Electric Company, Inc.	3065	
147a, 147b, 147c,	Filter Condensers, each 0.8 mfd., Paper	Western Electric Company, Inc., Three-Section Unit	1588	
148	Filter Choke, 8 henries	Western Electric Company, Inc.	1584	
149	Radio Choke	Western Electric Company, Inc.,	2092	
*150	Dynamotor	Western Electric Company, Inc., Per KS-5558—List 1	2927	
†150	Dynamotor	Western Electric Company, Inc. Per KS-5558—List 2	ES-691767	
152	Drop Resistor, 1500 ohms ± 2%, Porcelain, Special Finish	Western Electric Company, Inc.	3064	
164	Receptacle Ring for Plug PL-62 (Part of Socket SO-42)	Western Electric Company, Inc.	1350	
165	Receptacle Plate for Plug PL-62 (Part of Socket SO-42)	Western Electric Company, Inc.	2809, or ES-691979	
246	Sub-base M-158	Western Electric Company, Inc.	1964	
254	Snapslide	Western Electric Company, Inc. (Part of Dynamotor Unit Assembly ES-679750)	2540	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Stock No. Signal Corps*
259	Pin Plug	Western Electric Company, Inc. (Part of Receptacle Plate Assembly 2809), *or* Western Electric Company, Inc. (Part of Receptacle Plate Assembly ES-691979)	2661 ES-691967	
—	Snapslide Stud	Western Electric Company, Inc. (Part of Mounting Assembly 2483)	1959	
—	Shock Absorber	Lord Mfg. Co., Dwg. No. 100-PH-4 (Part of Mounting Assembly 2483)	2387	
G3480	Pole Shoe Assembly	Pioneer Gen-E-Motor Corp.	G3480	
G3482	Red Lead Assembly	Pioneer Gen-E-Motor Corp.	G3482	
G3483	Black-White Lead Assembly	Pioneer Gen-E-Motor Corp.	G3483	
G3484	White Lead Assembly	Pioneer Gen-E-Motor Corp.	G3484	
G3485	Black Lead Assembly	Pioneer Gen-E-Motor Corp.	G3485	
G3486	End Bracket and Brush Holder Assembly, L.V. End	Pioneer Gen-E-Motor Corp.	G3486	
G3487	Brush Holder Assembly, L.V. End	Pioneer Gen-E-Motor Corp.	G3487	
G3488	End Bracket and Brush Holder Assembly, H.V. End	Pioneer Gen-E-Motor Corp.	G3488	
G3489	Brush Holder Assembly, H.V. End	Pioneer Gen-E-Motor Corp.	G3489	
*G3491	Field Coil Assembly	Pioneer Gen-E-Motor Corp.	G3491	
†G3631	Field Coil Assembly	Pioneer Gen-E-Motor Corp.	G3631	
†G3630	Armature Assembly	Pioneer Gen-E-Motor Corp.	G3630	
G3492	Armature Assembly	Pioneer Gen-E-Motor Corp.	G3492	
P3253	End Bracket	Pioneer Gen-E-Motor Corp.	P3253	
P3391	End Bracket Cover	Pioneer Gen-E-Motor Corp.	P3391	
P3394	Screw	Pioneer Gen-E-Motor Corp.	P3394	
P3401	Ball Bearing	Pioneer Gen-E-Motor Corp.	P3401	
P3436	Brush Holder Lug	Pioneer Gen-E-Motor Corp.	P3436	
P3437	Bearing Retainer	Pioneer Gen-E-Motor Corp.	P3437	
P3439	Oil Slinger	Pioneer Gen-E-Motor Corp.	P3439	
P3442	Screw	Pioneer Gen-E-Motor Corp.	P3442	
P3516	Washer	Pioneer Gen-E-Motor Corp.	P3516	
P3596	Screw	Pioneer Gen-E-Motor Corp.	P3596	
P3678	Screw	Pioneer Gen-E-Motor Corp.	P3678	
P3679E	Brush, L.V. (+)	Pioneer Gen-E-Motor Corp.	P3679E	
P3680E	Brush, L.V. (−)	Pioneer Gen-E-Motor Corp.	P3680E	
P3690	End Bracket	Pioneer Gen-E-Motor Corp.	P3690	
P3787	Wire Cover	Pioneer Gen-E-Motor Corp.	P3787	
P3807	Washer	Pioneer Gen-E-Motor Corp.	P3807	
P4715	Set Screw	Pioneer Gen-E-Motor Corp.	P4715	
P4837	Nut	Pioneer Gen-E-Motor Corp.	P4837	

Reference	*Description*	*Manufacturer and Type*	*Western Electric Drawing No.*	*Signal Corps Stock No.*
P5009	Brush Cap	Pioneer Gen-E-Motor Corp.	P5009	
P5031	Stud	Pioneer Gen-E-Motor Corp.	P5031	
P5032	Shell	Pioneer Gen-E-Motor Corp.	P5032	
P5102	Brush, H.V. (+)	Pioneer Gen-E-Motor Corp.	P5102	
P5103	Brush, H.V. (−)	Pioneer Gen-E-Motor Corp.	P5103	
*P5115	Nameplate	Pioneer Gen-E-Motor Corp.	P5115	
†P5363	Nameplate	Pioneer Gen-E-Motor Corp.	P5363	
*P3441-A	Brush Spring, L.V.	Pioneer Gen-E-Motor Corp.	P3441-A	
†P5372	Brush Spring, L.V.	Pioneer Gen-E-Motor Corp.	P5372	
P3438-C	Brush Spring, H.V.	Pioneer Gen-E-Motor Corp.	P3438-C	

Electric Tolerances: In all cases where an electrical tolerance is not specified, it is to be understood that the allowable deviation from the nominal value is plus or minus 20%.

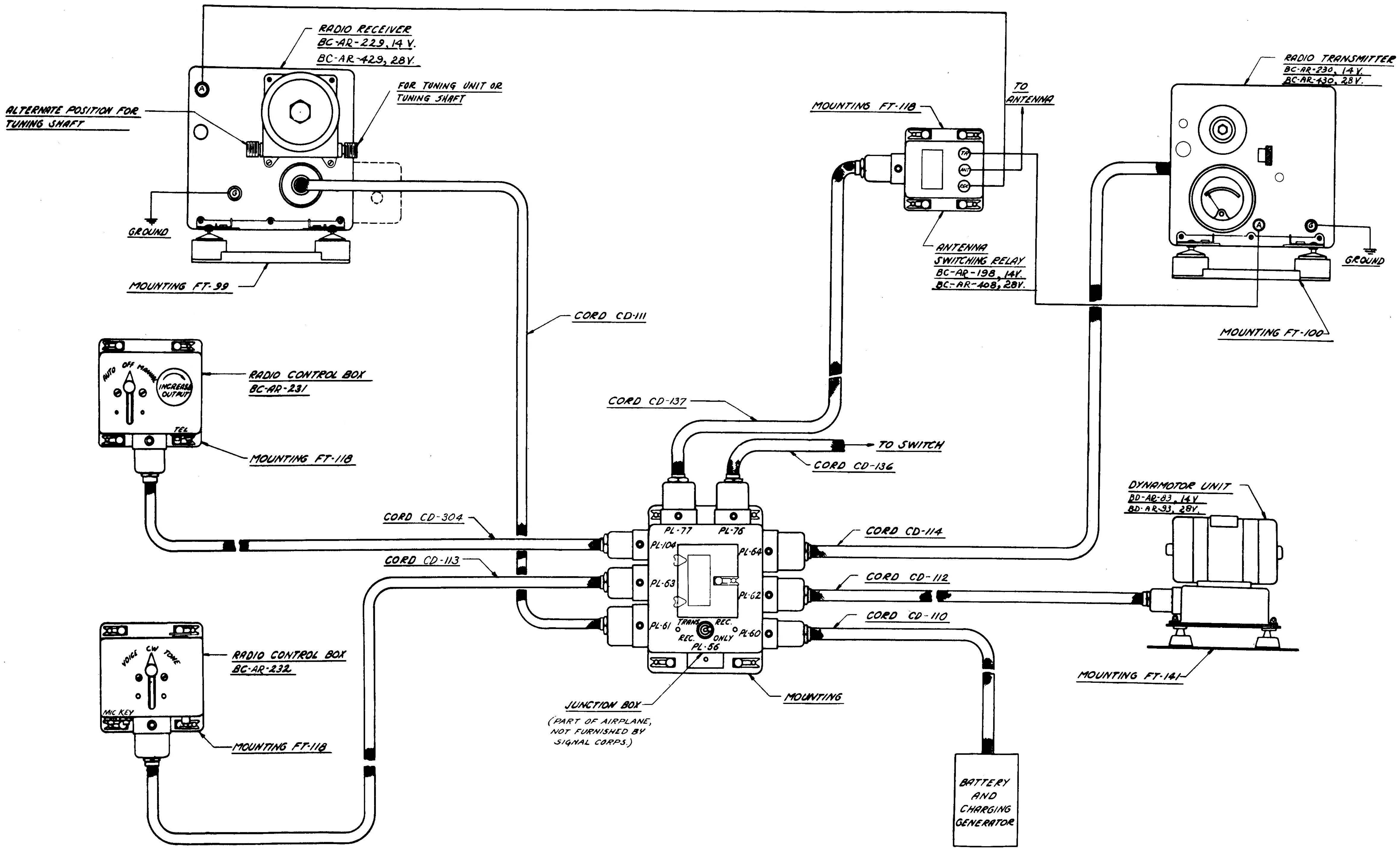

Fig. 1 - Cording Diagram for Radio Sets SCR-AR-183 and SCR-AR-283

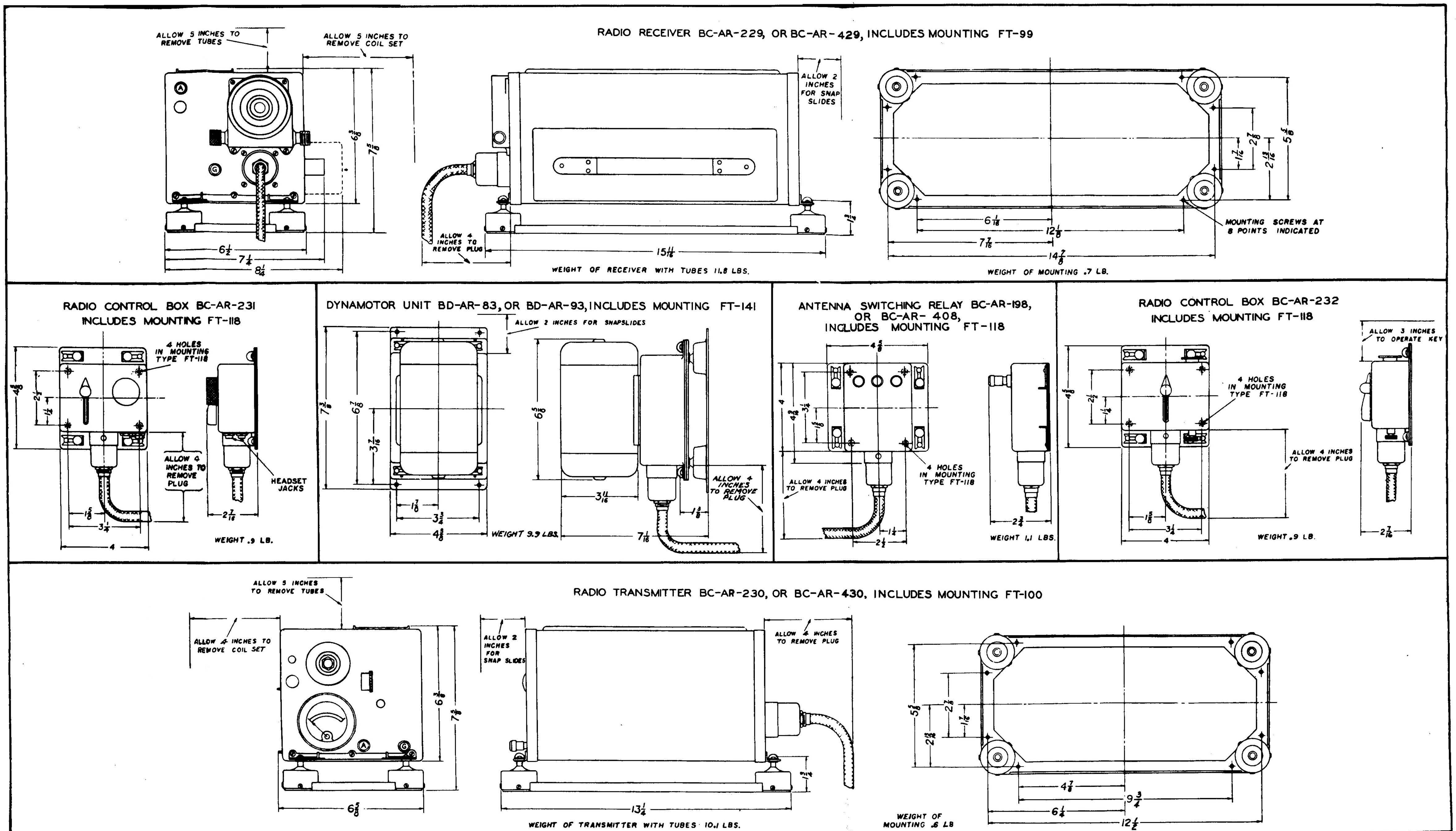

Fig. 2 - Installation Dimensions and Weights of Components used in Radio Sets SCR-AR-183 and SCR-AR-283

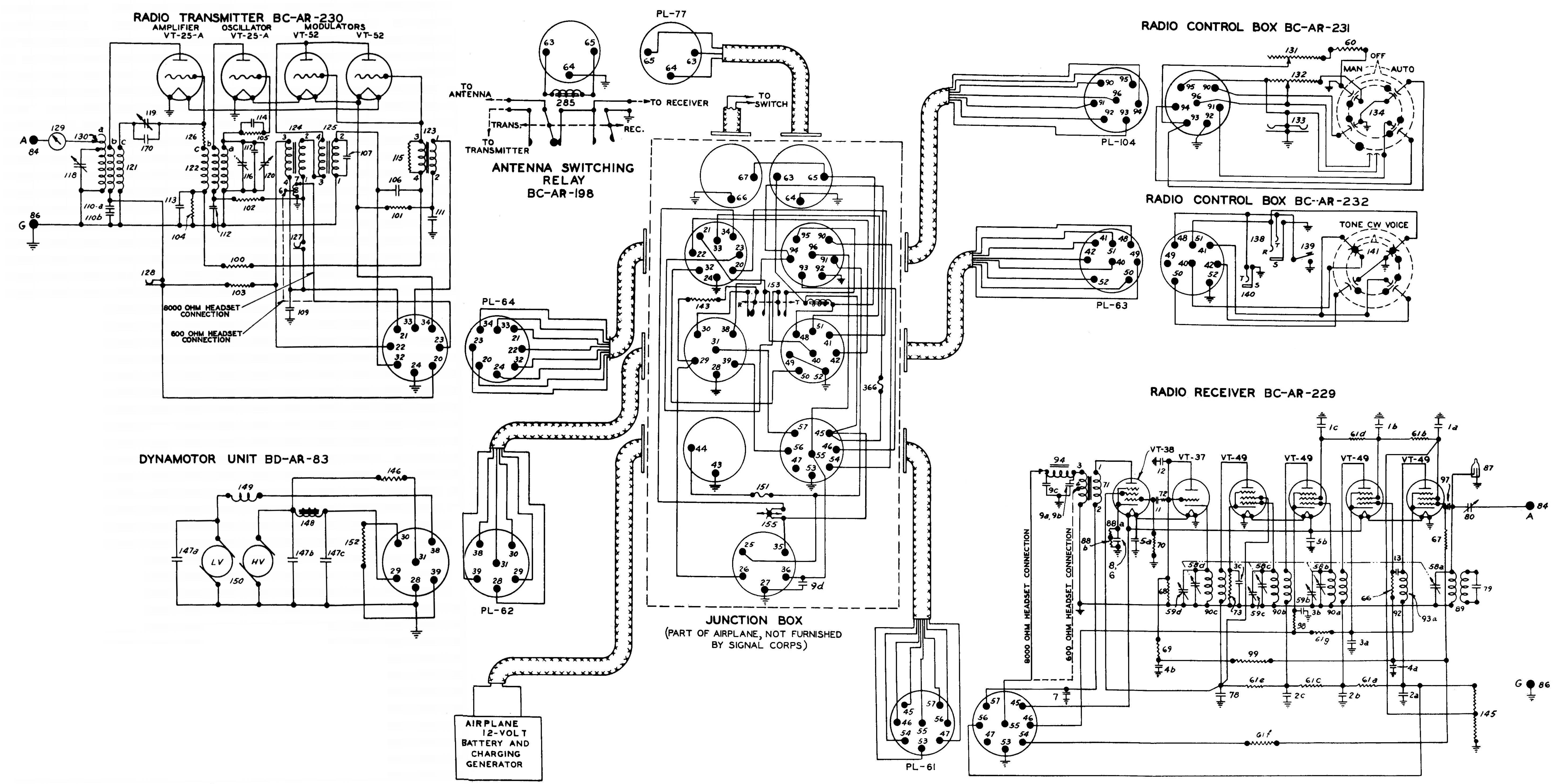

Fig.3 - Schematic Circuit Diagram Radio Set SCR-AR-183

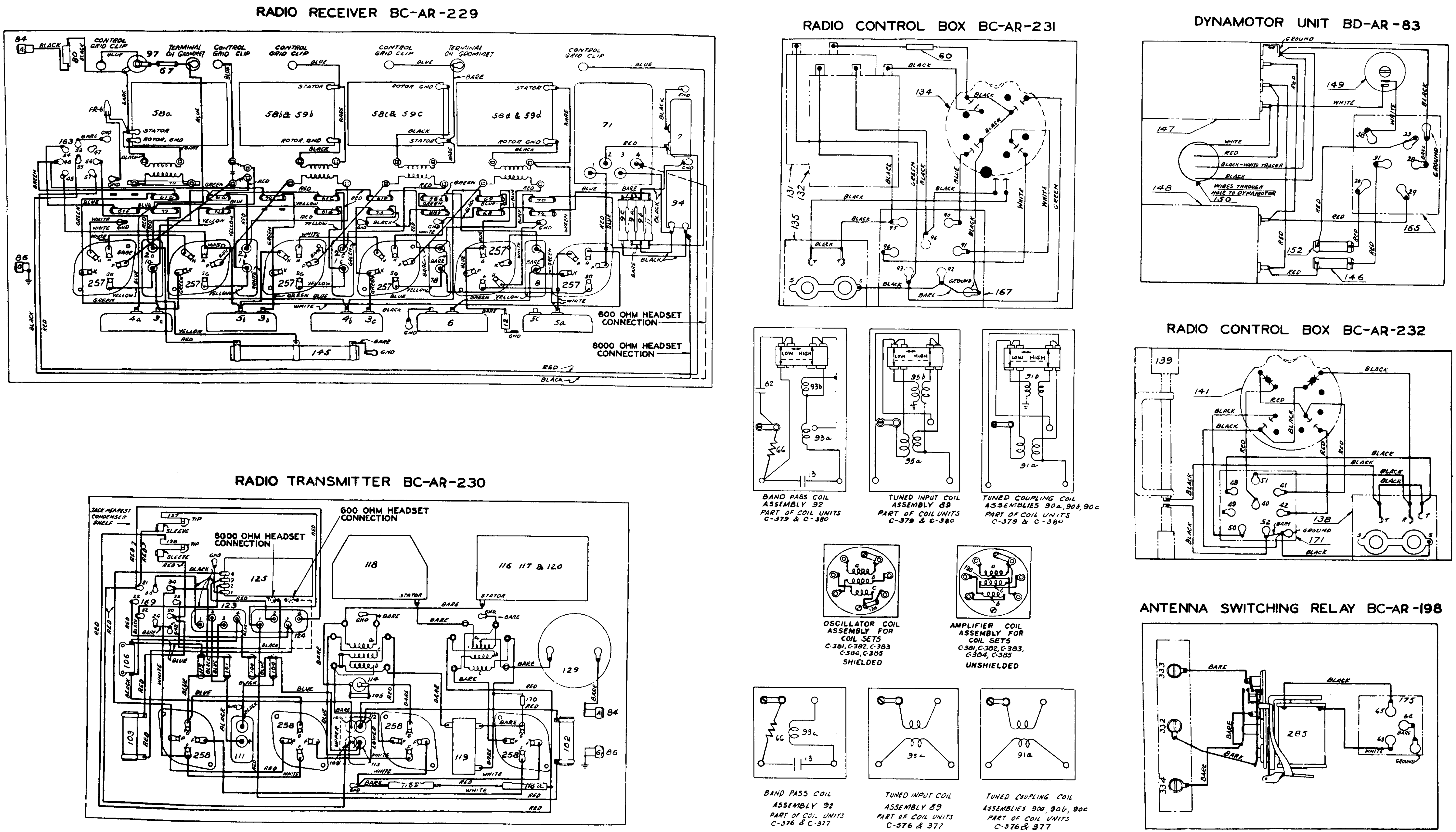

Fig. 4 - Practical Wiring Diagram, Components of Radio Set SCR-AR-183

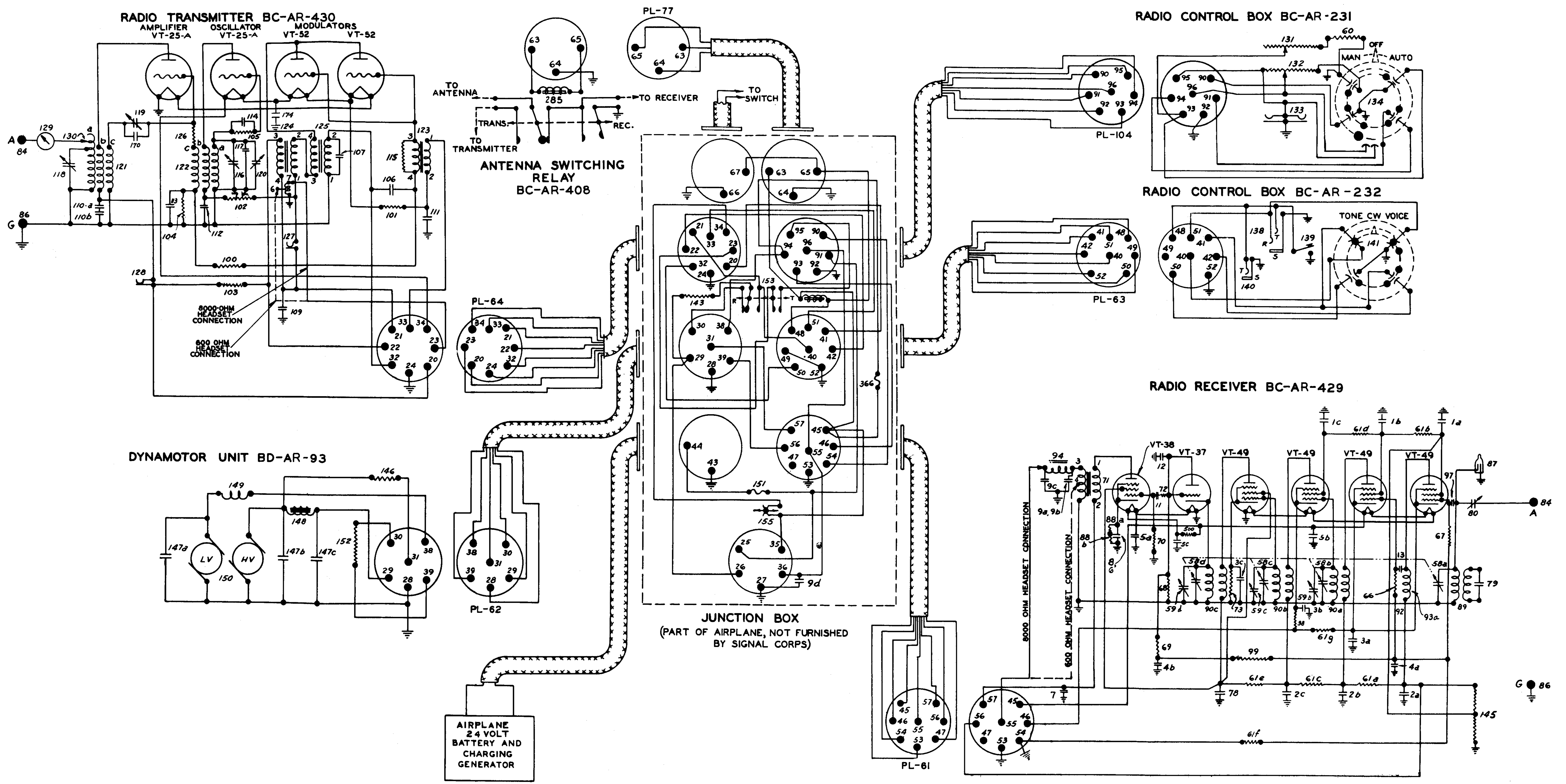

Fig. 5 - Schematic Circuit Diagram Radio Set SCR-AR-283

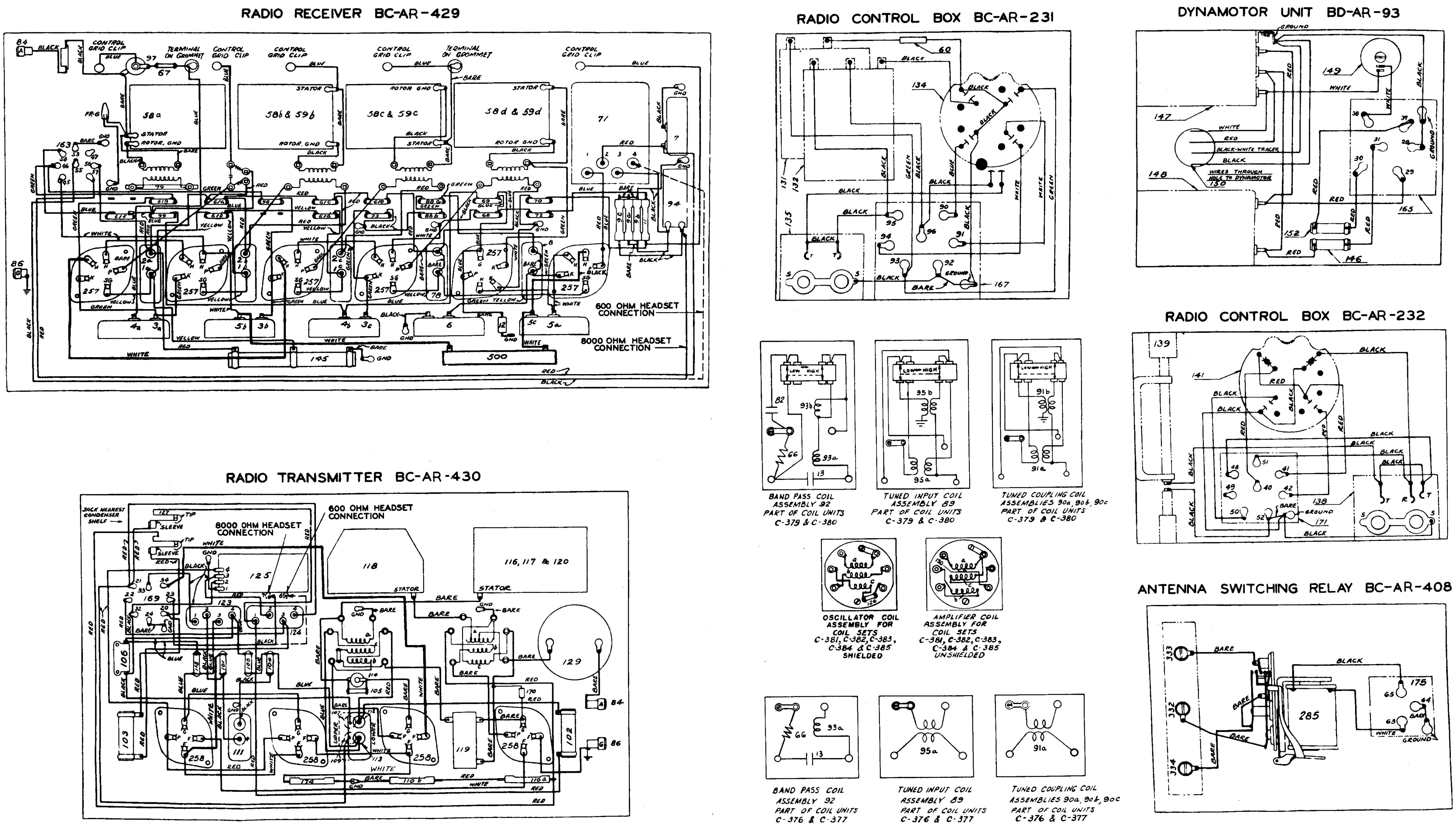

Fig. 6 - Practical Wiring Diagram, Components of Radio Set SCR-AR-283